SITE FORMATION PROCESSES AT THE BUTTERMILK CREEK SITE (41BL1239), BELL COUNTY, TEXAS

A Thesis

by

JOSHUA LAKE KEENE

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

August 2009

Major Subject: Anthropology

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Approved by

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Committee Members,	Ted Goebel
	Vatche Tchakerian
Head of Department	Donnie Hamilton

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ABSTRACT

Site Formation Processes at the Buttermilk Creek Site (41BL1239), Bell County, Texas. (August 2009)

Joshua Lake Keene, B.A., Eastern Washington University

Chair of Advisory Committee: Dr. Michael Waters

The archaeological literature warns against trusting the context of artifacts found within a vertisol due to the constant mixing of sediments caused by the shrink/swell properties of clays. These churning processes were thought to be the defining characteristic of vertisols until only the past few decades. It is now apparent that vertisols vary drastically based on a wide spectrum of variables and are fully capable of forming without churning processes.

The Buttermilk Creek Site, Block A represents a prime example of a minimally developed vertisol. In addition, the site itself is a heavily occupied lithic quarry that has been almost continuously inhabited since Clovis and possibly Pre-Clovis times. This thesis takes a detailed look at the sediments and distribution of lithic artifacts from Block A of the Buttermilk Creek site to address the two following research objectives: 1) to determine if the archaeological context within the floodplain sediments at Block A has been disturbed by post-depositional processes, and 2) to identify discrete occupation surfaces within the vertic floodplain sediments at the site. These objectives are addressed using a variety of methods, including: 1) plotting the stratigraphic position of diagnostic artifacts, 2) determining the size distribution of debitage and artifact quantities throughout the floodplain deposits, 3) examining the distribution of cultural versus non-cultural lithic material, 4) recording the presence or absence of heat alteration in the deposits, 5) creating maps showing the degree of fissuring across the site, 6) analyzing differences in patination on artifacts, and 7) analyzing the presence of calcium carbonate on artifacts from all levels.

Results from these analyses show that, despite the classification of sediments at Block A as a vertisol, vertical displacement of artifacts is largely absent. Chronologically ordered diagnostic points, consistently size sorted artifacts, and a lack of constant mixing of calcium carbonate throughout the profile suggest that artifacts found as deep as 20 cm below the Clovis-aged horizon represent intact cultural horizons. These oldest components found in Block A may represent some of the earliest known evidence of people in the New World.

ACKNOWLEDGEMENTS

A great number of people contributed to this project over the past few years. I would like to first thank Dr. Michael Waters for giving me the great opportunity to work with him and the Center for the Study of the First Americans on the Buttermilk Creek site assemblage, which has been a deeply edifying experience beyond anything I could have expected back in my undergraduate days. The CSFA has also provided the funding, lab space, and other resources necessary to make this project possible.

I would also like to thank Dr. Ted Goebel for his advice throughout the thesis writing process, not to mention helping me out whenever I needed to be reminded that I was, in fact, still not done with my thesis.

Thanks also go to Dr. David Carlson. Without his help and seemingly endless statistical know-how, none of the statistical analysis in this thesis would be possible.

I must thank Charlotte Pevny for her guidance and great advice throughout the entire process, not to mention all that she contributed to the original Gault excavations and publication. I also greatly appreciate the efforts of Jessi Halligan for her contributions to this work, as well as for putting up with me on a daily basis in the lab, in the field, and basically everywhere else, which can often be a mind-boggling experience. Thanks also to my fellow graduate students and good friends Megan Hawkins, Chris Crews, and Danny Welch for taking turns helping me and vice-versa when it comes to thesis-related malaise. I would also like to thank the original team Buttermilk: Tom Jennings and Ashley Smallwood for their help in the formative stages of this project. I could never have finished the mad amount of brute-force artifact and rock sorting in the lab without my right-hand man Rick Anderson and the lab-related efforts of Sarah McAndrews, Angela Gore, and Marco Garcia. Special thanks also to Laurie Lind for all that she does for the CSFA and for being patient with me.

Finally, I would like to thank the rest of the Buttermilk Creek crew members that had to endure the ostensibly un-ending wrath of my thesis during those brain-meltingly-hot and uncomfortably-soggy summer months in central Texas: Michael Quennoz, Phil Johnson, Larkin Kennedy, Sadie McDaniels, John Blong, Heather Smith, Heather Hatch, Sunshine Thomas, Melanie Rogers, Tim Riley, Shannon Bowman, Jim Weiderhold, Bill Dickens, Becca Sager, Juan Juarista, Chris Bartek, Katie Hill, Christine Jones, Victoria Springer, Tim DeSmet, Paul Santarone, Scott Justen, Hector Weir, Ailene Lovings, Shawn Bibby, Laura Short, Miss Sue, and Bucky.

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CHAPTER I

INTRODUCTION

Vertisols (a.k.a. grumusols or rendzinas) are clay-rich soils that shrink and swell as a result of wetting and drying. These soils tend to form in alluvial sediments and exist in a variety of locations across the globe, with India and Australia having the most concentrated distributions. Other regions where vertisols are common include Sudan, southeastern China, Ethiopia, and the United States. In the latter over half occur in the state of Texas (Coulombe et al. 2000; Duffield 1970). Vertisols in Texas tend to occur along the Gulf coast as well as parts of northern and central Texas and along the Rio Grande River in southern Texas (Figure 1.1).

It has been proposed in the archaeological literature (Duffield 1970; Johnson et al. 1987; Schiffer 1987; Wood and Johnson 1978) that the process of shrinking and swelling in a vertisol leads to pedoturbation, or a "self-plowing" effect on materials buried in these sediments. This effectively destroys soil horizonation and causes materials buried in these sediments to be vertically displaced, disrupting the context of any buried occupation surfaces by moving artifacts vertically throughout the profile. For this reason, the context of buried archaeological sites found in vertisols should be highly suspect.

Numerous sites have been identified as being disturbed by shrink-swell processes (Brakenridge 1984; Butzer 1982; Cahen and Moeyersons 1977; Duffield 1970; Hofman

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This thesis follows the format and style of *American Antiquity*.

1986; Hoyer 1980; Jacob 1995; Johnson 1972; Morris et al. 1997). However, the only archaeological models that deal with the mixing of artifacts within a vertisol are based on observation and lack the quantitative analysis necessary to determine the exact properties of artifact movement. Instead, it is generally assumed that any archaeological site found in soils with vertic properties will be in a disturbed context. Recent research on vertisols in the geo-sciences, however, suggests that the effect of shrink-swell on soils varies greatly from one location to the next. Furthermore, the model of "self-plowing" once believed to be the defining characteristic of vertisols (Soil Survey Staff 1975), plays a much more limited role in the formation of vertisols than previously thought (Ahmad 1983; Dasog et al. 1987; Wilding and Tessier 1988;Yaalon and Kalmar 1978). For this reason, it should be possible, given the right conditions, to have an archaeological site within a vertisol with minimal post-depositional disturbance.

A thorough understanding of the vertic properties affecting site context is required at Block A since alluvial sediments at the site are massive and unstratified, preventing the identification of clear cultural horizons by conventional means. Identifying the vertic properties of Buttermilk Creek Block A is crucial because it has the potential to provide important chronological control for several Paleoindian components in Texas. In addition, 1000's of artifacts were found that seemingly underlie Clovis-aged materials at Block A. This may indicate occupations that pre-date Clovis, of which no indisputable evidence has yet been found anywhere in the New World.

Research Objectives

The purpose of this thesis is to study the site formation processes of the Buttermilk Creek site (41BL1239) excavation at Block A, in Bell county, Texas. This is a multi-component site 500 meters from the Gault site (41BL323) with a large concentration of artifacts ranging from late prehistoric to early Paleoindian and possibly pre-Clovis in age. Because the soils at this site have many of the criteria necessary to form a vertisol, it should be a prime candidate to test the models of artifact movement mentioned earlier.

Specifically, I explore whether the archaeological context within the floodplain sediments has been disturbed by post-depositional processes, and whether time-sensitive cultural horizons within the vertic floodplain sediments can be identified. To achieve these goals, I: 1) plot the stratigraphic position of diagnostic artifacts, 2) determine the size distribution of debitage and artifact quantities throughout the floodplain deposits, 3) examine the distribution of cultural versus non-cultural lithic material, 4) record the presence or absence of heat alteration in the deposits, 5) create maps showing the degree of fissuring across the site, 6) note differences in patination on artifacts, and 7) note the presence of calcium carbonate on artifacts from all levels. Identifying intact occupation surfaces allows for a better understanding of the extent of occupation at the Buttermilk Creek site as well as provides the means to re-create the history of deposition at the site throughout the late Pleistocene and Holocene.

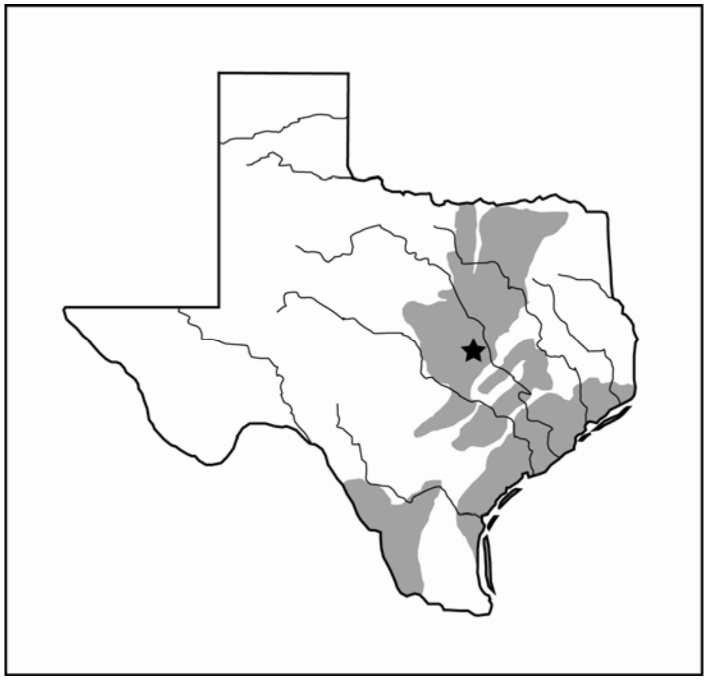

Figure 1.1. Distribution of Texas vertisols and the Buttermilk Creek site
(After Duffield 1970).

CHAPTER II

REVIEW OF VERTISOLS AND PEDOTURBATIVE PROCESSES

Classic Definition of Vertisols

Vertisols are defined as any sediment with a high enough smectitic clay content (>30%) (Dudal and Eswaran 1988) to cause a high degree of volume change with variation in moisture content. Extensive shrinking and swelling occurs most in regions with defined wet and dry seasons, as vertisols have a very low hydraulic conductivity and require extended periods of precipitation followed by long periods of aridity to fully wet and dry. During dry periods soils contract and cracks form at the surface, reaching a minimum of 50 cm below the surface and 1 cm thick at this depth (Soil Survey Staff 1975). Cracks in some areas are capable of reaching depths of several meters and can be up to 15 cm wide at the surface (Ahmad 1983). In addition, lateral and vertical forces result in the formation of wedge-shaped pedological features and shear planes along which soils move called slickensides (Lynn and Williams 1992).

In the classic view of vertisols, the defining characteristic is a constant mixing of sediments within a profile. The pedological forces that result from the shrinking and swelling of soils cause a certain amount of mixing to occur as sediments are shifted both vertically and laterally in the profile. These forces prevent the proper formation of clear soil horizons and have the potential to move materials buried in the soil. The process of argilliturbation in particular, also known as “self-plowing” or “self-swallowing” (Buol et. al. 1973; Soil Survey Staff 1975; Schiffer 1987; Wood and Johnson 1978), is of particular concern to archaeologists. When vertisols contract during the dry season, cracks form that allow sediments from the surface and sidewalls of cracks to move downward into the profile (Figure 2.1). Rehydration during the wet season causes re-expansion of the clays and the closing of cracks. The addition of extra material to the bottoms of cracks results in increased pressures which then force the sediment upward, resulting in a constantly mixing profile in which materials are continuously dropped down into cracks and then pushed back up to the surface. This process would effectively destroy any occupation surfaces by mixing archaeological materials throughout the profile (Schiffer 1987; Soil Survey Staff 1975; Wood and Johnson 1978).

Vertisols in Archaeological Context

A number of archaeological sites show signs of post-depositional disturbance as a result of argilliturbation within vertisols (Brakenridge 1984; Butzer 1982; Cahen and Moeyersons 1977; Duffield 1970; Hofman 1986; Hoyer 1980; Jacob 1995; Johnson 1972; Morris et al. 1997). In practically all of these examples, artifacts are assumed to have been relocated based on observation and the idea that vertisols uniformly mix soil horizons. While all these cases do show varying degrees of vertical displacement, little is done to quantitatively determine to what degree mixing is taking place and how far artifacts are moving. The following examples show what effects vertisols can have on archaeological sites, as well as show how archaeologists have handled vertisols in the past.

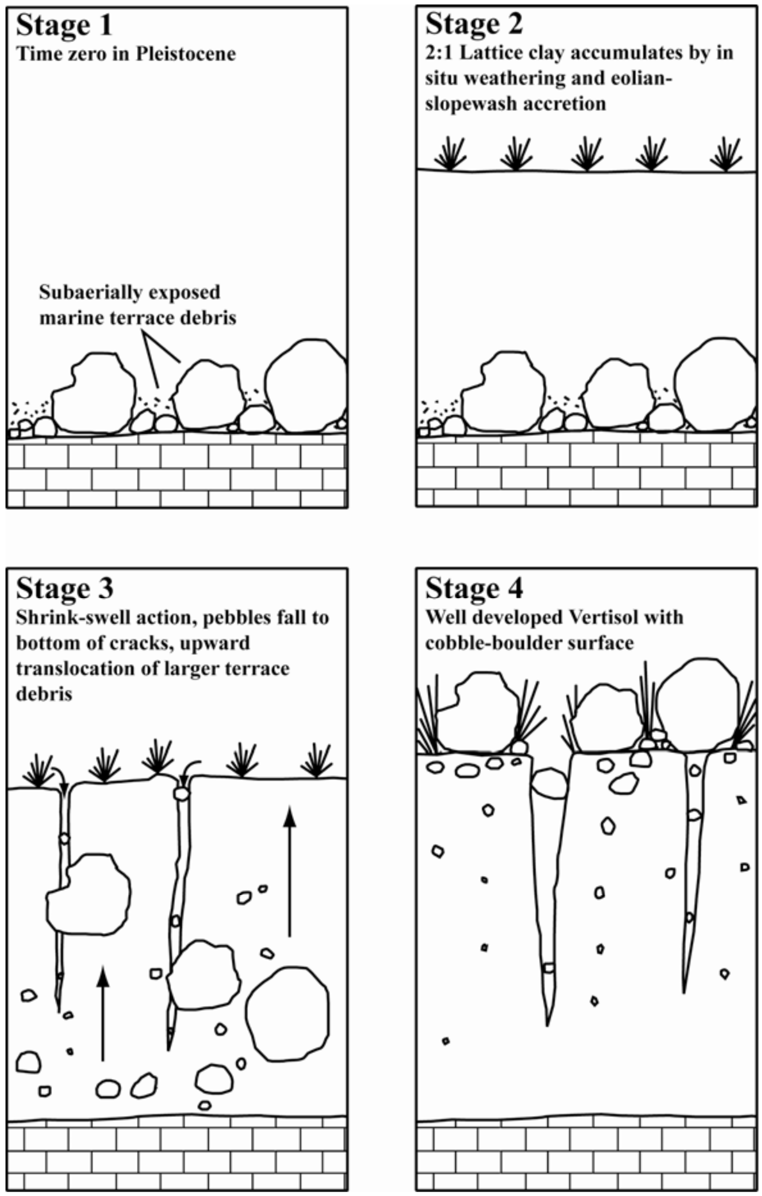

Figure 2.1. Hypothetical sequence of vertisol churning and pavement formation beginning at time zero in the Pleistocene (after Johnson 1972).

San Miguel Island, CA

Johnson's (1972) dissertation about landscape evolution on San Miguel Island off the coast of California is a classic example of vertic forces disturbing an archaeological site and serves as the basis for his future research on how vertisols disrupt cultural horizons (Johnson et al 1987; Wood and Johnson 1978). The site occurs in a uniform, clayey sediment within a marine environment. Johnson describes a "pavement" of large cobbles that go no deeper than 6-12 inches below the surface and attributes this formation to argilliturbative forces moving clasts vertically in the profile. Conversely, smaller artifacts were found throughout the profile. While materials were pushed upward by expansion forces, small artifacts and rocks fell back into cracks. Larger rocks and cobbles, however, were too large to fall back down clay cracks, causing a size-sorting of large versus small materials. Subsequent grain size, soil composition, and organic analysis further confirmed that mixing was occurring, resulting in soil uniformity. From this, Wood and Johnson (1978) developed a hypothetical model showing the effects vertisols have on archaeological horizons (Figure 2.1).

Fottbridge, Strawn Creek, and Pecan Springs Sites

Duffield (1970) visited three sites in parts of Texas where vertisols are most ubiquitous. He explains the problematic properties of vertisols at these sites, describing them as "tumultuous, heaving soils churning archaeological features into a homogenous mass and totally destroying the original context of a site" (1970:1055). In some cases, diagnostic artifacts were found in mixed or even reversed stratigraphic order. Using these examples, Duffield strongly cautions against trying to correlate artifacts with cultural horizons or radiocarbon dates in soils with shrink-swell properties.

Maya Lowlands

Jacob (1995) describes the pedological processes affecting archaeological sites in the Maya Lowlands of Mesoamerica. Shrink-swell forces in this area are so active as to produce extremely hummocky micro-topography known as gilgai. Soil profiles show sediment horizons as shifted to near vertical by sediment expansion forces. However, despite this extruding of sediments upward, portions of these horizons were still sufficiently intact to reconstruct site formation processes and past vegetation and climate records. This example shows a case in which, despite extreme expansion and contraction forces, enough intact sediment was present to obtain organic samples for climate reconstruction.

Summary

Johnson (1972) describes soil movement based on grain analysis and presence of organics in the horizon. However, in all these cases, none have performed an extensive analysis on the artifacts themselves. Duffield (1970) briefly alludes to the reversal of diagnostic artifacts in a profile, but this falls short of the extensive mapping and size-sorting that would provide enough detail to truly see the extent to which vertisols affect archaeological sites. Recent work on vertisols in the geo-science literature argues that vertisols do not move materials vertically with as much consistency as previously thought.

Vertisols from a Pedologic Perspective

The archaeological perception of vertisols as ineviTable destroyers of archaeological sites is based on the classic view that self-plowing is the driving force behind most vertic characteristics (Soil Survey Staff 1975). More recent studies by soil scientists, however, argue that self-plowing does not play as strong a role in vertisol formation as previously thought. Features such as poor horizonation, wedge-shaped peds, slickensides, and gilgai relief are now believed to be related to the mechanics of differential shrink/swell rather than mixing (Ahmad 1983; Dasog et al 1987; Wilding and Tessier 1988; Yaalon and Kalmar 1978). A more detailed understanding of vertisols based on pedologic literature is necessary to better understand the properties that govern vertic forces and mixing processes.

Properties of Vertisols

To classify as a vertisol, a soil must have the following characteristics: 1) at least 50 cm of sediment before reaching any sort of lithic, paralithic, or petrocalcic horizon such as bedrock; 2) greater than 30% clay content (usually smectite) to a depth of 50 cm or greater; 3) open clay cracks at some point in the year that are at least 1 cm wide at a depth of at least 50 cm below the surface; and 4) either gilgai relief, slickensides close enough to connect, wedge-shaped peds, or any combination of these (Dudal and Eswaran 1988, Soil survey Staff 1975).

Vertisol formation depends greatly on the composition of local sediments. As mentioned previously, a minimum clay content of 30% is necessary for vertisols to form (Soil Survey Staff 1975). Some vertisols may have a clay content as high as 90%, while some soils with less than 30% clay content may still yield vertic properties (Coulombe et al. 2000). It is classically believed that smectites are the principal component of clays in vertisols due to their greater capacity for shrink/swell of their crystallographic structure. This is due to three factors: "(1) greater thermodynamic stability than reference materials; (2) a higher layer charge (> 0.45 per half unit cell) which may be as high as vermiculite or illite and in return impact the availability of of some ions such as K and NH_4; (3) a higher Fe content in their crystallographic structure" (Coulombe 2000:E-277). Recent studies, however, show that smectite itself only contributes 10-30% of the change in volume of a vertisol. While smectites are still often a principal component in many vertisols, shrink-swell is more dependent on the porosity and water absorption capability of clays. This, in turn, depends on the type and surface area of the mictrostructure of clay particles (Tessier 1984). Therefore, clay in a vertisol may be composed of any number of clays with potentially pedogenic properties, such as smectite, kaolinite, illite, halloysite, or hydroxyl-interlayered smectite, to name a few (Coulombe 2000).

Shrink-swell can also be effected by the presence of flocculating agents that bind clays into larger masses, lessening shrink-swell phenomena. Flocculating agents can include organic materials, gypsum, or carbonates. In vertisols, sediments nearer the surface are often more heavily leached and have greater shrink-swell. Conversely, deeper sediments where carbonates, gypsum, and organic materials precipitate from solution tend to have less volume change with moisture content (Williams et al. 1996).

General Vertisol Profile

A standard vertisol profile can be separated into five zones as shown in Figure 2.2. While different profiles may lack one or more of zones 2, 3, or 4, the general location of these zones stays consistent. Dudal and Eswaran (1988) describe these zones as follows.

Zone 1. This top layer is usually about 30 cm thick and is considered to be the plow zone. Sediment tends to be very hard and cracked when dry, forming large prism-like chunks up to 30 cm wide.

Zone 2. This 10-30 cm thick zone lies underneath the plow zone and consists of hard, blocky, prism-like elements and is more compact than zone 1. This layer is still heavily cracked.

Zone 3. This zone can range anywhere from 10 cm to over 1 m in thickness. In this layer, the soil forms naturally wedge-shaped peds with their long axes tilted between 10 and 60 degrees (Figure 2.2). These peds tend to be between 5-10 cm long and have ped faces that are smooth or striated. These peds are related to slickenside formation seen in zone 4. They form as a result of lateral and angled forces acting on the sediment due to shrink-swell which cause the sediment to split along planes of weakness.

Zone 4. Slickensides dominate this zone, which ranges from 25 cm to about 1 m thick. Slickensides are shear planes of movement that form on the surfaces of wedge-shaped peds similar to those mentioned earlier. However, as opposed to zone 3, slickensides can extend across a much larger area (600-2000 cm^2). These can be identified by a shiny and polished appearance on peds that may also be striated by larger grains during movement. Slickensides tend to be oriented in semi-parallel groups at an angle (Figure 2.2). The top surface of this zone tends to be curved or undulating in microtopographic highs and lows that correspond with gilgai formation visible on the surface. Knight (1980) describes gilgai as a series of small mounds and depressions that form in vertisols with a relief of 15 cm or greater (Figure 2.2). These tend to form as a result of enhanced expansion in areas with greater degrees of clay-cracking. These areas tend to be where depressions form, as lateral pressures force sediment to the side and upward into areas with fewer cracks, forming mounds. The base of these depressions can be the location of a master slickenside which is a large slickenside that acts as a plane of movement along which materials from depressions move laterally and upward into mounds (Figure 2.2). Regions with minimal shrink-swell forces have minimal gilgai formation in the form of a gently sloping undulation, or may not even show signs of gilgai at all.

Zone 5. This is a massive layer composed of clay that undergoes only minimal moisture variations. As a result, wedge-shaped formations, slickensides, and other signs of shrink-swell activities are absent.

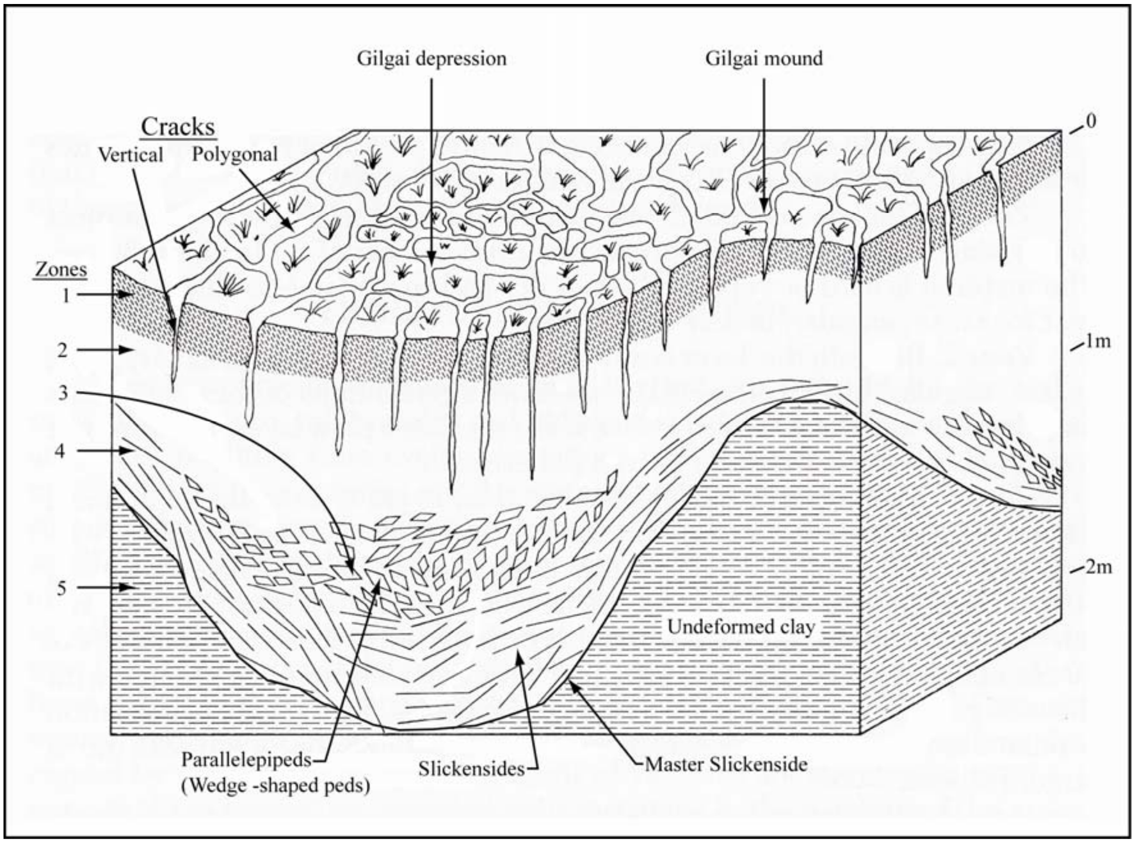

Figure 2.2. Representative vertisol cross section showing characteristic vertic features (after Dudal and Eswaran 1988).

Pedogenic Models of Vertisols

Self-Plowing Model. This is the classic model for pedoturbation originally presented Johnson (1972) and Buol et al. (1973). As described earlier, materials falling into cracks from the surface cause increased upward pressure on surrounding sediments, forcing them upward in a constant mixing process. This was originally considered to be the driving force behind vertisol formation, resulting in poor horizonation and the formation of wedge-shaped peds, slickensides, and gilgai. However, recent studies have since downplayed the significance of this process in many cases of vertisol formation.

Soil mixing should lead to a complete homogenization of a soil profile, but this is often not the case in vertisols. Yaalon and Kalmar (1978) sampled organics throughout a vertisol profile in Israel. A fully-mixed profile should have dates with no relationship to depth, but their samples showed a steadily increasing mean residence time (MRT) with depth, indicating less vertical mixing then was expected. The authors also observed slickenside formation below the maximum depth of cracks, contradicting the assumption that such vertic features are formed by expansion around clay cracks. In another study by Dasog et al. (1987), pedoturbation was shown to be sufficient to prevent horizonation within a vertisol in Saskatchewan, but “insufficient to counter leaching and illuviation in subhumid soils” (pp. 1243).

More recently, Southard and Graham (1992) analyzed the distribution of cesium-137 within a vertic profile. Cesium-137 was produced as a side-effect of above ground nuclear testing and allowed the authors to measure the degree of mixing from the surface of a vertisol 60 km southeast of Sacramento. Results indicated that cesium-137 was moving within the profile as a result of pedoturbation, but much more inconsistently and at a slower rate than previously thought. Most incorporation of surface materials over the 25 years since the end of peak nuclear testing occurred within the top 20-30 cm of the vertisol, and did not occur uniformly across the profile. Mixing was shown to occur at a slower rate than organic carbon deposition.

These sources indicate that this form of pedoturbation is much more moderate than previously believed, with the potential to occur minimally or not at all in certain areas, thus negating the importance of self-plowing as a defining characteristic of vertisols. A more in-depth understanding of slickensides and gilgai formation indicates that materials do not move straight upward, as shown in Figure 2.1. Rather, pressure from overlying sediments forces expansion and contraction to move materials more laterally along slickenside planes as described in the second model of pedoturbation.

Soil Mechanics Model. In this model of pedoturbation in vertisols, soils tend to shift and form slickensides, wedge-shaped peds, and gilgai without substantially mixing surface sediments within the profile. The basis of this model is that, upon normal swelling due to moisture absorption, two sets of forces act on buried soils: lateral and vertical. When vertical stresses are confined by overbearing sediments and lateral forces exceed the shear strength of the soil, failure occurs at an angle ranging from 10 to 60°, creating slickensides and wedge-shaped peds. Once formed, slickensides serve as the plane along which expansion forces move sediments (Ahmad 1983; Knight 1980; Wilding and Tessier 1988). It is stated by Knight (1980) states that a large slickenside can form along the entire base of a bowl or depression and he calls this a master slickenside.

Wilding and Tessier (1988) hypothesize slickensides first form in areas with large clay cracks. When these sediments re-wet, they are forced laterally and upward along slickenside planes forming an undulating topography with the lows located in areas of extreme cracking. These microlows would then collect water and serve to increase the amount of leaching in these areas, which in turn increases the degree of clay cracking due to higher moisture variability and a greater concentration of non-carbonate clays. The end result is the formation of gilgai microrelief and slickensides unrelated to pedoturbative mixing processes.

Conclusion

This new model of pedoturbation indicates that vertisols can form without necessarily requiring the destructive mixing processes formerly thought to be definitive of vertisols. While evidence clearly exists that archaeological sites can be disrupted by pedoturbative forces, it is not a requirement. The rest of this thesis examines archaeological materials recovered from the Buttermilk Creek site, a Paleoindian site in central Texas located on floodplain sediments with vertic properties. This is an ideal location, as vertic properties exist but are subdued, showing minimal sign of vertical displacement, as described in detail in the following chapter. This thesis analyzes the degree of vertical displacement of artifacts and determines whether discrete, in-context archaeological horizons can be identified. If so, this could prove valuable in future dating studies and analyses of these occupations as well as provide quantitative data demonstrating the properties of movement and mixing within a vertisol.

CHAPTER III

BUTTERMILK CREEK SITE FORMATION STUDY

The Buttermilk Creek site (41BL1239) is in the southernmost region of the Great Plains physiographic province of North America. More specifically, the site is located in central Texas in south-central Bell County. The site is one of many Paleoindian locales found on the Edwards Plateau, adjacent to the Rolling Plains in the north and the Gulf Coastal Prairies to the east (Toomey et al. 1993). The Buttermilk Creek site is positioned about 500 m northeast of the Gault site (41BL323) and, more than likely, represents an extension of the activities performed there (Figures 3.1 and 3.2).

The proximity of the Buttermilk Creek site to the Balcones Escarpment, the geologic fault zone that creates a rich ecotone between the savannas of the Edwards Plateau and the riperian habitats of the Blackland Prairie, sets the stage for a unique archaeological record that spans over 13,000 years (Collins and Hester 1998). This environment is a prime location to exploit the limestone uplands of the plateau and the contrasting landscape of the Blackland Prairie.

The local geographic setting of the Buttermilk Creek site further suggests its importance to hunter-gatherers of prehistory. The site sits just west of the ecotone on the northeastern portion of the Edwards Plateau and is located in a small wooded valley near the headwaters of Buttermilk Creek. Buttermilk Creek incises the limestone bedrock of the Lampasses Cut Plain and joins Salado Creek before it eventually drains into the Brazos River (Black 2002). Buttermilk Creek cuts into the Edwards Limestone and

Comanche Peak Limestone formations, both of which are identified as part of the Lower Cretaceous Fredericksburg Group (Barnes 1974). This fine-grained bedrock contains abundant outcrops of high-quality Edwards chert nodules or tabular pieces, a common form of crypto-crystalline silicate found across the Edwards Plateau (Banks 1990). The presence of this abundant high-quality chert source, coupled with the reliable water source of Buttermilk Creek, creates an appealing setting for early hunter-gatherers in the region.

Excavation Method

Excavation at Buttermilk Creek began in 2006 with the excavation of Blocks A and B (see Figure 3.2 more a site map). Subsequent excavations occurred in 2007 and 2008, with further excavations planned for 2009. The focus of this thesis is on materials from Block A located in the southwestern portion of the property. Over the course of the three years working at Block A, crews from Texas A&M University excavated a total of 41 units. Initial work in 2006 consisted of a 2-by-2 m test pit excavated in 10 cm levels and screened through ¼" (0.625 cm) screen. In 2007 and 2008, upper layers of prehistoric and Archaic sediments were removed rapidly with minimal screening and mapping Deeper levels were generally excavated in 2.5 cm levels and screened through ¼" (0.625 cm) screen with samples screened through 1/8" (0.3125 cm) screen. The leveling system used for all excavation is based on the standard set by excavations by Texas A&M at the Gault site (41BL323) in 2000 and 2001 (see Table A.1 in Appendix

A for specific elevations). Surface levels at Block A range from levels 11-13, with each level representing of 5 cm of depth. In 2007, 2.5 cm levels (numbered as A and B subdivisions of each level) began at level 27, representing the estimated boundary between early Archaic and Pleistocene aged materials. In 2008, 2.5 cm levels were excavated beginning at level 31, suspected to be the boundary between late Paleoindian and Folsom-aged materials (based on diagnostic artifacts). See Appendix A for a more detailed report on excavation and lab methods.

Geologic Setting

Dr. Steven Driese of Baylor University (2008) provides a summary of soil characterization, micromorphology and composition at Block A. Sediments at the Buttermilk Creek site, Block A are characteristic of typical alluvial floodplain deposition with no apparent breaks or erosional episodes evident from 20-120 cm below the surface. Underlying these sediments is degraded limestone colluvium underlain by limestone bedrock.

Figure 3.3 shows approximate A and B horizons identified at Block A, though vertic processes have prevented the formation of distinct soil horizons. The clay content and profile thickness as well as presence of some clay cracking and slickenside formation are sufficient to characterize these soils as having vertic properties. However, these features are weakly to moderately developed.

Clay Content

Sediment samples were taken throughout the profile by Driese (2008) in both the microtopographic high and microtopographic low shown in Figure 3.3. These samples showed that soils at Block A consist of approximately 80% total clays, with 60% made up of pedologic clays. The clay mineralogy is composed primarily of smectite and kaolinite with traces of illite. These are sufficient levels of clay content to meet the criteria of a vertisol.

Cracks

Vertical cracks visible in the profile in-filled with darker surface sediments reach a maximum thickness of approximately 1.5 cm, with most cracks ranging in thickness from 1 to 10 mm, often disappearing completely in many areas with greater depth (see Appendix E for details). Level maps show that crack thickness at level 27 (approximately 70 cm below surface) averages 1 cm in the southeast corner of the 2007 block and 5 mm in the rest of the block. This decreases with depth; from level 30 and below, where cracks average only 1-2 mm in thickness.

Calcium Carbonate

Substantial leaching has removed carbonates from the upper 40-50 cm of the profile. The lower layers, however, have extensive evidence of unleached, detrital carbonate and secondary precipitated carbonate in the form of coatings and films on grains and artifacts.

Slickensides and Microtopography

Enough shrink-swell has occurred to create wedge-shaped peds and slickenside formation at Block A. These are visible in Figure 3.3; however, there is only minimal microtopographic formation, with relief of approximately 10 cm between micro-highs and micro-lows. This shallow topography combined with the lack of evidence of master slickenside formation does not meet the criteria necessary for proper gilgai formation (Knight 1980).

While clay content is high at Block A, vertisols can are weakly developed. While 1 cm wide cracks can be found as deep as 70 cm in a few isolated instances, most the rest of the block barely meets the minimum requirement for a vertisol of 1 cm wide cracks at 50 cm below surface. This and the relative shallowness of the profile prevents the more intense churning processes apparent in areas with deeper clays. In addition, the high quantities of calcium carbonate beginning around 50 cm below the surface (levels 24-25) likely act as a flocculating agent, retarding the shrink-swell process in these lower layers. Finally, the weak/non-existent development of gilgai formation further indicates weak vertisol development. These features suggest that Block A is a weakly developed vertisol and predict that very little mixing of archaeological materials should occurred at Block A.

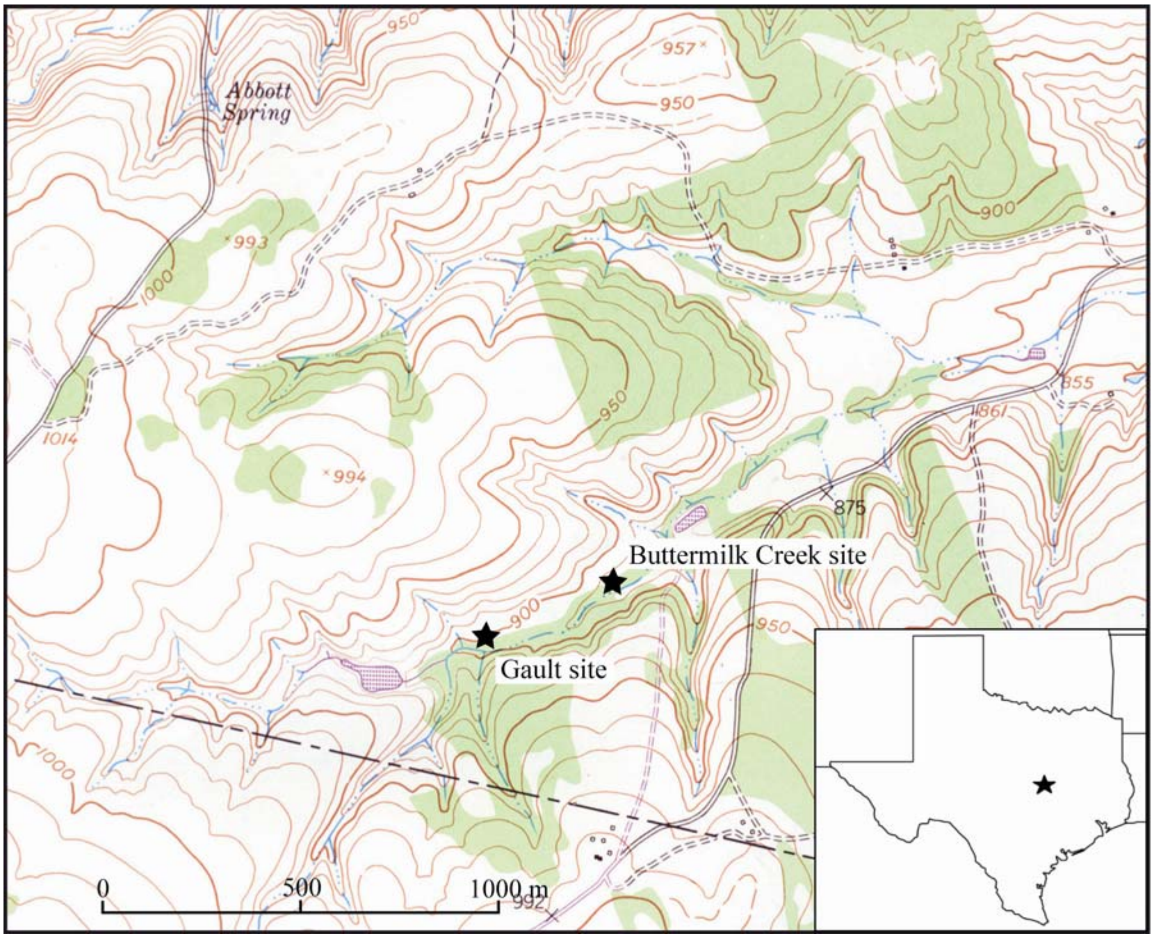

Figure 3.1. Topographic map showing locations of the Gault (41BL323) and Buttermilk Creek (41BL1239) sites.

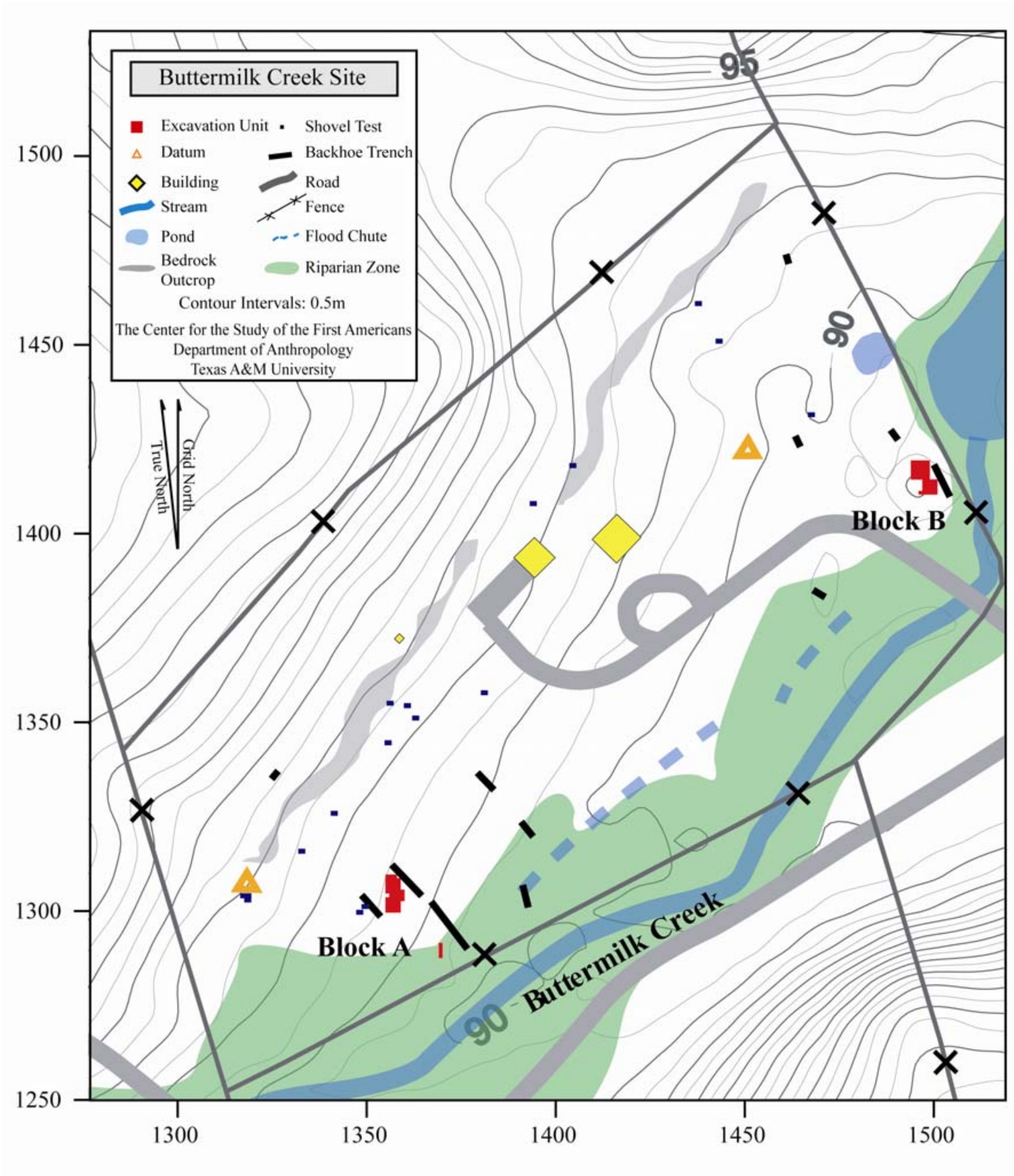

Figure 3.2. Buttermilk Creek (41BL1239) site map[1].

[1]Grid northing and easting coordinates (m) based on Gault site datum

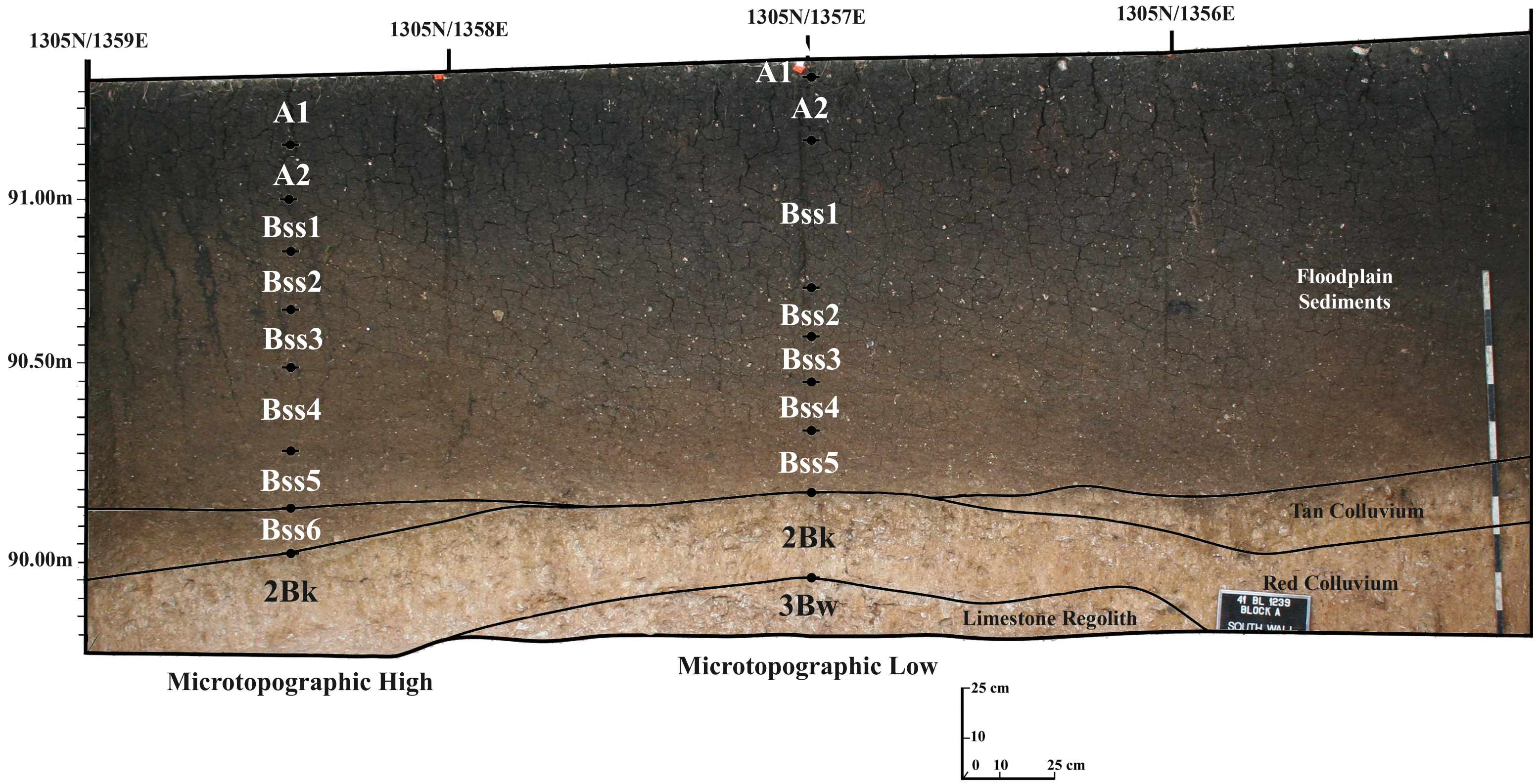

Figure 3.3. Block A 2007 south wall profile with approximate locations of soil horizons.

Methods

This analysis focuses on materials collected during the 2006-2008 field seasons at Buttermilk Creek Block A (Figures 3.3 and 3.4). While some useful information is provided by all three years of excavation, the majority of this thesis covers the 2007 materials only. The 2006 test-pit materials, while capable of giving a rough estimate of artifact distribution, were excavated slow enough to provide accurate data. Furthermore, the 2008 materials are mostly not included in this thesis due to time constraints. They will be addressed in future publications. Following are the eight lines of evidence that have been collected from Block A to address my two research questions.

1) Diagnostic Artifacts

The locations of diagnostic artifacts (i.e., identifiable projectile points) from 2006-2008 were plotted throughout the vertical profile. Since the majority of diagnostic artifacts were piece-plotted within 0.2 cm accuracy, their vertical context can be used to determine whether the geologic context of the site has been affected by mixing. If the sediments are disturbed, artifacts will appear in a mixed chronological order; however, if sediments are undisturbed, these artifacts should appear in chronological order and can then be used to provide approximate dates for cultural horizons.

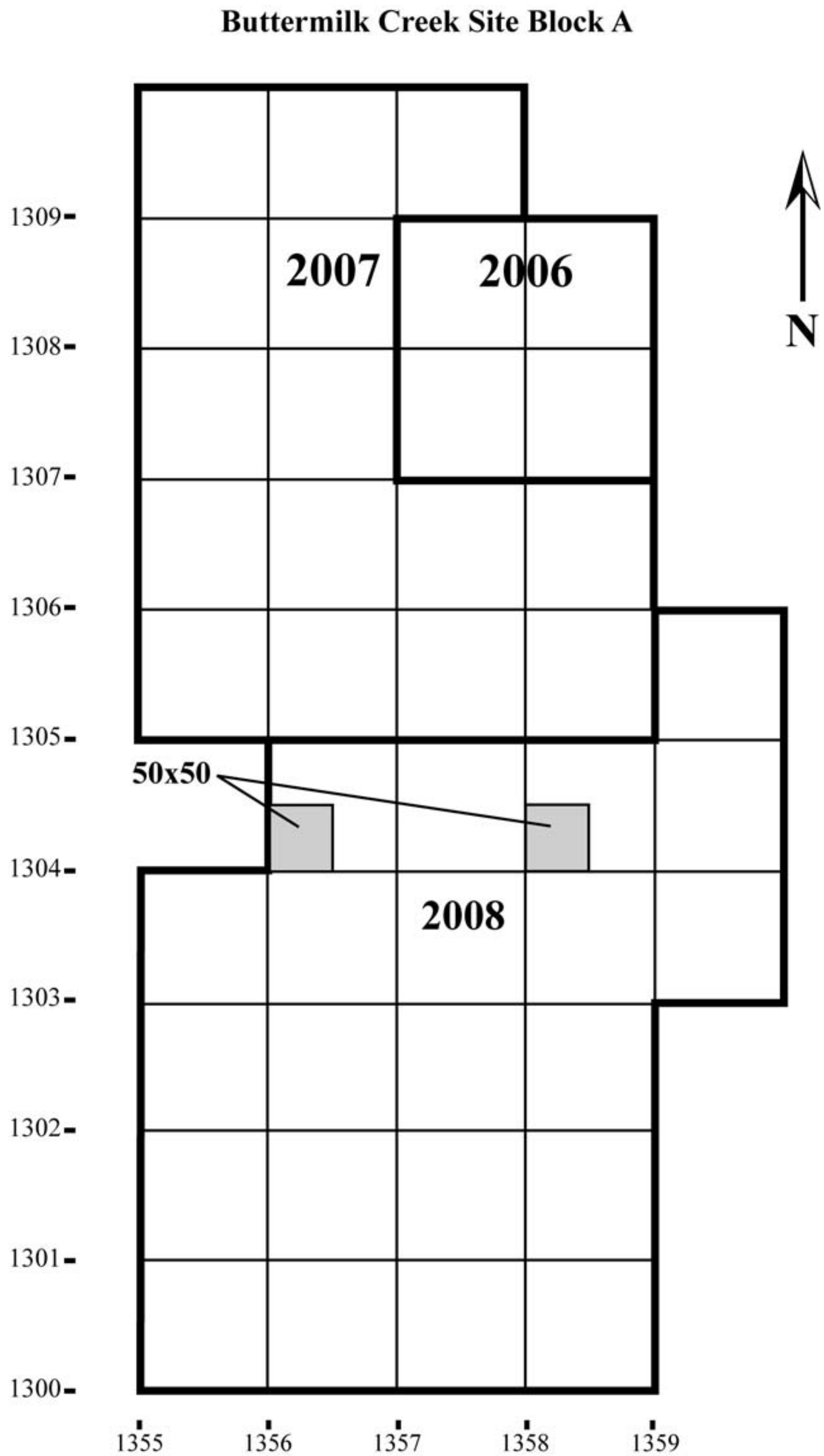

Figure 3.4: Map of excavated units from Block A. Gray squares represent 50-by-50 cm units excavated in 2.5cm levels and screened through 1/8” (0.3125cm) mesh

2) Debitage and Artifact Quantities and Size Distribution

After initial counts were taken, the debitage and other cultural materials from the 2007 excavations were sorted in the laboratory for each 2.5 cm level using a series of geologic sifting screens. The screen sizes correlate with those used to sort debitage from the Texas A&M excavation at the Gault site. These categories are shown in Table 3.1.

Table 3.1 Lithic artifact size categories

Size class	**Screen size**
1	1 1/2" (3.75 cm)+
2	1 - 1 1/2" (3.75-2.5 cm)
3	3/4-1" (1.875-2.5 cm)
4	1/2-3/4" (1.25-1.875 cm)
5	3/8-1/2"(0.95-1.25 cm)
6	1/4-3/8" (0.625-0.95 cm)
7	1/8”-1/4" (0.3125-0.625 cm)
8	<1/8" (0.3125 cm) 50x50 samples only

Size classes 1-7 were considered for every unit excavated during the 2007 excavation season. In addition, micro-debitage from the 1/8” (0.3125 cm) samples collected from 50-by-50 cm units (1304N/1356E and 1304N/1358E) were also sorted in order to provide information on the movement of smaller materials not preserved in the normal ¼” (0.625cm) screened sample.

The relative percentages of each size class should remain constant from level-to-level in each unit if the archaeological material is in an undisturbed vertical context. Initial analyses of debitage from the 2006 excavation revealed relatively little vertical mixing of debitage (see Appendix D). The analysis presented here will determine to what degree materials have shifted and which size classes have been most affected. Additionally, if the disturbance of sediments is proven to be minimal, concentrations of archaeological materials in the stratigraphic profile are used to identify occupational surfaces.

3) Distribution of Cultural vs. Non-Cultural Lithic Materials

In 2008, two 50-by-50 cm units were excavated along the northern border of Block A from the surface down to sterile degraded limestone in 2.5 cm intervals. These sediments were then screened through 0.3125 cm steel mesh and all materials remaining in the screens were collected, providing a sample of both cultural lithic materials and native, un-modified rocks, pebbles, and calcium carbonate nodules.

These materials were sorted into three categories: cultural lithic debris and artifacts, non-cultural pebbles and rocks deposited through alluvial and colluvial processes, and calcium carbonate nodules that formed in place through chemical leaching processes. Cultural lithic materials were compared with non-cultural lithics to ascertain whether these materials were deposited as a result of human activity or whether their distribution can be explained by the same natural processes that deposited the non-cultural lithic materials. Calcium carbonate was purposefully left out of this analysis because it is not deposited by natural or cultural forces, but instead forms in place gradually over long periods of time due to chemical leaching.

4) Crack/Fissure Mapping

All units in Block A consisted of very fine-grained alluvial sediments that contained fissures that later became filled with darker clays. These cracks formed as a result of dehydration of the fine-grained sediments which caused contraction and cracks to form that later filled with sediments from the surface (Johnson 1972; Wood and Johnson 1978). These fissures, as well as krotovina, were mapped for each level of each unit during excavation. Comprehensive maps of these disturbances show the degree of fissuring and animal burrowing across the entirety of the 2007 and 2008 excavations. Distribution and density of these disturbances is compiled and compared with artifact size-sorting data to see how artifact distribution compares with distributions of cracks and krotovina, as well as to provide a better understanding of geological processes affecting the site.

5) Presence or Absence of Heat Alteration

In a sample of four 1 m units from the southern portion of the 2007 excavation, each size class was further sorted based on the presence or absence of heat alteration. For this study, burning is defined based on the presence of replicable criteria, including potlidding, crenation, and crazing, that occur on lithic artifacts as a result of rapid heating of chert causing explosions due to expansion. Purdy (1975) describes potlidding as a spalling of round flakes from the surface of a chert fragment with no discernable bulbs of force. Crenation also occurs when cherts are exposed to extreme heat and results in the lateral fracturing of flakes, often in curved or “half-moon” shaped fragments with no discernable bulb of percussion (Purdy 1975). Crazing occurs when chert is exposed to extreme heat and can be recognized as a series of shrinkage-cracks on the surface of a piece of chert (Purdy 1975). Characteristics such as color change and luster, which may be open to interpretation or may not be detecTable on smaller pieces, was not considered.

Concentrations of artifacts with a higher percentage of heat alteration within the stratigraphic profile may represent occupational surfaces. Additionally, recording the concentrations of heat-altered artifacts can provide useful information for future spatial analyses of Block A.

6) Presence of Calcium Carbonate ($CaCO_3$)

The presence or absence of calcium carbonate on flakes and artifacts was recorded. Flakes and tools found within the lower gray-brown sediments are frequently encrusted with $CaCO_3$, while lithic materials found in the younger dark gray clays are almost completely lacking calcium carbonate. The presence or absence of $CaCO_3$ on archaeological materials was noted for each size category in each level from a sample of four units from the 2007 excavation. An increase in the frequency of $CaCO_3$ at greater depths would indicate post-depositional processes affecting these sediments. Presence or absence of $CaCO_3$ can then be used as an indicator of post-depositional shifting of materials.

7) Patination

Cultural material from the Buttermilk Creek site almost exclusively comes from local deposits of Edwards chert. Edwards chert artifacts recovered from Block A have different types of patina. Patination of lithic materials is caused by the deterioration of the outer surface of the rock by chemical, physical, and biological processes. Because of the wide variety of processes that can cause patination, slight changes in environmental or depositional setting can result in different types of patina formation (Krauskopf 1979). Lithic artifacts from Block A fall into three general categories of patination based on observations during excavation and initial analysis of the 2006 Block A materials: unpatinated, blue/white speckled patination, and white patination.

The occurrence of different patinas was noted for each size class for each level from a sample of four units from the 2007 excavation. The distribution of different types of patination were then mapped throughout the stratigrtaphic profile to see if different types of patination could be mapped and pinpointed to specific horizons. Unfortunately, this sorting proved problematic as it was exceedingly difficult to identify clear boundaries between different patination colors, leading to a lack of replicability in sorting. The end results showed no discernable pattern and this avenue of analysis was abandoned (see Appendix F for criteria, results).

Summary

The Buttermilk Creek site (41BL1239), located in the southernmost region of the Great Plains physiographic province, is a prime locale for human occupation due to its proximity to a high quality source of Edwards chert, as well as its abundant plant and animal resources and proximity to Buttermilk Creek. This likely resulted in the frequent re-occupation of the site from the late Pleistocene to European contact which is seen in the extensive archaeological record uncovered during excavations in 2006-2008.

At Block A, massive alluvial sediments show very little sign of clear stratigraphic differentiation. This, in addition to signs of clay cracking and high clay content suggest that the archaeological materials recovered at Block A may have been affected by vertic processes. However, initial analysis of the soils suggests that, while soils at Block are technically vertisols, argilliturbative processes are minimal due to shallow deposition, narrow cracks, high calcium carbonate content, and no sign of extensive gilgai or master slickenside formation.

The rest of this thesis will look at the archaeological materials themselves to determine how much vertical mixing is occurring. Methods for this analysis include: examination of time-sensitive diagnostic artifacts, size sorting of cultural as well as non-cultural lithic materials throughout the profile, mapping of all disturbance features and plotted artifacts at 5 cm intervals, examination of artifacts for presence of heat alteration or calcium carbonate encrustation, and the sorting of materials based on patination to determine if changes occur with depth. These avenues of analysis will first determine to what degree vertical movement is occurring, if at all, and second identify chronologically significant cultural horizons at Block A.

CHAPTER IV

ANALYSIS AND RESULTS

The following analyses all approach the same two questions using different methods: What post-depositional processes are affecting archaeological materials at Block A of the Buttermilk Creek site, and how are these processes reflected in the archaeological record? To answer these questions, diagnostic artifact distributions, cultural and non-cultural lthic sorting, presence of heat alteration, $CaCO_3$ formation, clay disturbance maps, and patination were analyzed.

Distribution of Diagnostic Artifacts

Stone tools have specific morphological characteristics that change over time as a result of changes in technology, function, availability of resources, and local stylistic variation. This allows them to be organized into spatially and chronologically specific groups or typologies (Andrefsky 2005). Projectile point typologies in particular are useful examples of this concept due to their highly formalized nature. Since all projectile points (i.e. spears, darts, and arrows) need to be hafted to a specific shaft and function effectively as a projectile, they tend to be highly standardized. As a result, once a projectile point style has been found and absolutely dated by other means, ity can then be used as chronological marker and can be used to provide rough absolute dates for a site.

The high degree of wetting and drying at the Buttermilk Creek site effectively destroys all organic materials, preventing the use of radiocarbon dating. However, due to its proximity to an enormous source for high quality Edward's chert, this site was almost continuously occupied since the Paleoindian period and massive quantities of lithic materials were deposited by prehistoric groups. Amongst these materials, 54 diagnostic projectile points were recovered ranging in age from early Paleoindian to late prehistoric periods. The distribution of projectile points within the profile can directly show to what degree lithic materials are being displaced by pedoturbative forces. In an undisturbed soil profile, projectile points should be ordered chronologically, with older types occurring beneath younger types; however, if substantial mixing is occurring, this should be reflected by randomly ordered point styles throughout the profile.

Point Identification and Dating

Points found at Buttermilk Creek Block A were mapped in place and their exact coordinates recorded. They were then assigned types based on morphological traits (Perttula 2004; Shafer, personal communication 2009, Turner and Hester 1993). Table 4.1 shows a list of point types seen at Buttermilk Creek and their associated age ranges and sites. For each type, an absolute date was assigned based on radiocarbon dating and a period was assigned using the archaeological chronology of central Texas defined by Collins (2004).

Using these ages for diagnostic point styles, approximate ages can be assigned to horizons at Block A. Table 4.2 shows a complete list of all diagnostic points found along with their elevations and assigned ages based on the typology presented in Table 4.1. These ages are then placed on a timeline that corresponds with the elevations at which diagnostic points were found (Figure 4.2) to show their vertical distribution.

Results

The distribution of points indicates an increase in age with depth. The uppermost 30 cm (levels 11-16) consists of a somewhat mixed combination of Late Archaic points such as Fairland, Edgewood/Ensor, and Darl, late prehistoric style points such as Perdiz and Scallorn, and Early-Mid Archaic points like Bell, early Triangular, and Early Split-Stem forms. This is followed by about 10 cm of sediment without any diagnostic artifacts (levels 18-19). Beneath this lies a series of early Archaic and late Paleoindian points such as Wells, Angostura and Golondrina style dart points. At this depth, there is a tighter grouping between similar point styles. All in-context Golondrina points fall within 15-20 cm of each other and overlap with the distribution of Angostura points. This can be explained by the overlap in dates between Angostura and Golondrina (Table 4.1). This range of Golondrina through Angostura may represent repeated occupations over the course of hundreds of years.

Three very thin biface fragments with evidence of strong fluting are considered to be diagnostic of Folsom technology (see Appendix B Figures B.1 a, b, and c for illustrations). These diagnostic Folsom artifacts show tight vertical grouping, with all three artifacts occurring within no more than 3 cm of each other, despite their wide dispersal across the excavation block (units 1303N/1358E, 1305N/1356E, and

Table 4.1. Projectile point types and associated ages

Point Type	Approx. Age Range (^{14}C yr BP[1].)	Period	Sites	Sources
Perdiz	750 - 450	Late Prehistoric	Mitchell Ridge, Devil's Mouth, Oblate, Kyle, Wheatley, Finis Frost	Ricklis (2004); Turner and Hester (1993)
Scallorn	1,250 - 750	Late Prehistoric	Smith Rockshelter, Evoe Terrace, Frisch Auf!, Blue Bayou	Ricklis (2004); Turner and Hester (1993)
Darl	1,750 - 1,200	Late Archaic	Leove-Fox, tombstone Bluff, Jetta Court, Evoe Terrace	Collins (2004); Turner and Hester (1993)
Ensor/ Edgewood	1,750 - 1,200	Late Archaic	Loeve-Fox, Mackin, Pecan Springs, Cooper Reservoir, Jake Martin	Prewitt (1981); Turner and Hester (1993)
Fairland	1,750 - 1,200	Late Archaic	Greenhaw, Loeve-Fox, Choke Canyon, Perry Calk	Turner and Hester (1993)
Bell	5,000 - 6,000	Early-Middle Archaic	Landslide, eagle Cave, Bonfire Shelter, Jetta Court, Wilson-Leonard	Collins (2004); Turner and Hester (1993)
Early Triangular	5,600 - 5,500	Early-Middle Archaic	Panther Springs Creek, Landslide, La Jita, Dan Baker, Wounded Eye, Wilson-Leonard	Collins (1998); Turner and Hester (1993)
Martindale	7,000 - 6,000	Early Archaic	Bluff, Tombstone, La Jita, Jetta Court, Wilson-Leonard	Collins (1998); Prewitt (1981); Turner and Hester (1993)

Table 4.1 (cont.)

Point Type	**Approx. Age Range (^{14}C yr. BP[1].)**	**Period**	**Sites**	**Sources**
Wells	7,000 - 6,000	Early Archaic	San Geronimo, Youngsport, Granite Beach, Tombstone Bluff, Wilson-Leonard	Collins (1998); Prewitt (1981); Turner and Hester (1993)
Early split Stem	8,000 - 6,000	Early Archaic	Richard Beene, Wilson-Leonard, Sleeper, Jetta Court, Youngsport	Collins (2004)
Gower	8,000 - 6,000	Early Archaic	Youngsport, Granite Beach, Jetta Court, Landslide, Wilson-Leonard	Collins (1998); Prewitt (1981); Turner and Hester (1993)
Angostura	9,500 - 8,000	Late Paleoindian/ Early-early Archaic	Richard Beene, Wilson-Leonard, Levi Rock Shelter, Loeve-Fox, Richard Beene	Bousman et al. (2004); Collins (2004); Decker et al. (2000); Thoms and Mandel (2007); Turner and Hester (1993)
Golondrina-Barber	9,500 - 8,400	Late Paleoindian	Wilson-Leonard, Baker Cave, Lamb's Creek Knoll	Bousman et al. (2004)
Dalton	10,500 – 10,000	Late Paleoindian	Levi Rockshelter, Leove, Tombstone Bluff, Yarbrough, Jake Martin, Dalton	Bousman et al. (2004); Shott & Ballenger (2007); Turner and Hester (1993)
Folsom	10,500 – 10,200	Early Paleoindian	Folsom	Meltzer et al. (2006)

Table 4.1 (cont.).

Point Type	**Approx. Age Range (^{14}C yr. BP[1].)**	**Period**	**Sites**	**Sources**
Clovis	11,050 - 10,900	Early Paleoindian	Lange-Ferguson, Sloth Hole, Anzick, Dent, Paleo Crossing, Domebo, Lehner, Shawnee-Minisink, Murray Springs, Colby, Jake Bluff, Clovis	Waters and Stafford; 2007

[1]radiocarbon years before present

Table 4.2. Time Sensitive Artifacts from Buttermilk Creek Block A.

AM No.	**Top Elevation**	**Level**	**Type**	**Period**
2651-3	91.501	11	Perdiz	late prehistoric
2054-2	91.455	12-14	Perdiz	late prehistoric
2054-?	91.43 - 91.30	12-14	Possible Darl	early Archaic
2054-?	91.43 - 91.30	12-14	Possible Angostura	late paleoindian
2054-3	91.41	12-14	Gower	early Archaic
2054-4	91.39	12-14	unknown	Archaic
4002-3	91.38 - 91.05	13-25	Fairland	late Archaic
2650-2	91.38	11-13	Edgewood	terminal Archaic
2651-10	91.374	13	Fairland	late Archaic
4001-4	91.373	13	late stage biface	Archaic
4006-2	91.367	13	late stage biface	Archaic
4002-1	91.347	14	Scallorn	late prehistoric
4011-1	91.329	14	early split stem	early Archaic
4027-2	91.30 - 91.00	15-20	unknown	Archaic
4008-1	91.295	15	late stage biface	Archaic
4012-1	91.29	15	late stage biface	Archaic
4005-2	91.285	15	Bell	early Archaic
4002-2	91.283	15	Edgewood	late Archaic
4005-3	91.28	15	early triangular	early Archaic
4006-4	91.234	16	late stage biface	Archaic
4012-2	91.215	16	late stage biface	Archaic
4028-4	91.208	16	Bell	Archaic
2650-23	91.188	17	Fairland	late Archaic
2656-34	91.174	17	Edgewood	terminal Archaic
4010-2	91.172	17	unknown	paleoindian
4005-6	91.048	20	Wells	early Archaic

Table 4.2 (cont.)

AM No.	Top Elevation	Level	Type	Period
2137-1	91.03	21	Angostura	paleoindian
2675-2	90.998	19-21	Wells	early Archaic
4028-6	90.98 - 91.30	15-21	Golondrina	paleoindian
2666-1	90.972	19-21	Angostura	paleoindian
4046-1	90.835	24	Angostura	paleoindian
2175-14	90.80 - 90.70	25-26	Golondrina	paleoindian
4008-2	90.73	26	late stage biface	paleoindian
4171-1	90.717	26	Lacoleate biface	late paleoindian
4159-1	90.70 - 90.65	27	Angostura	paleoindian
2195-3	90.70 - 90.60	27-28	Golondrina	paleoindian
2806-1	90.674	27a	Golondrina	paleoindian
4181-1	90.669	27b	Golondrina	paleoindian
4160-1	90.661	27	Golondrina	paleoindian
2879-9	90.643	28a	Angostura	paleoindian
2875-5	90.609	28b	late stage biface	paleoindian
4242-1	90.605	28	late stage biface	paleoindian
2933-1	90.596	29a	Golondrina	paleoindian
2951-1	90.557	29b	Golondrina	paleoindian
4260-1	90.556	29	Dalton/Meserve	late paleoindian
4296-1	90.54	30	late stage biface	paleoindian
4289-1	90.526	30	late stage biface	paleoindian
4377-1	90.481	31a	late stage biface	paleoindian
4447-1	90.468 - 90.435	31b	Folsom	paleoindian
3069-6	90.455	31b	Folsom	paleoindian
4525-1	90.438	32a	Folsom	paleoindian
4551-4	90.432	32a	Possible Clovis	paleoindian
4581-7	90.4	32b	Possible Clovis	paleoindian
4833-1	90.322	34b	Martindale	early Archaic

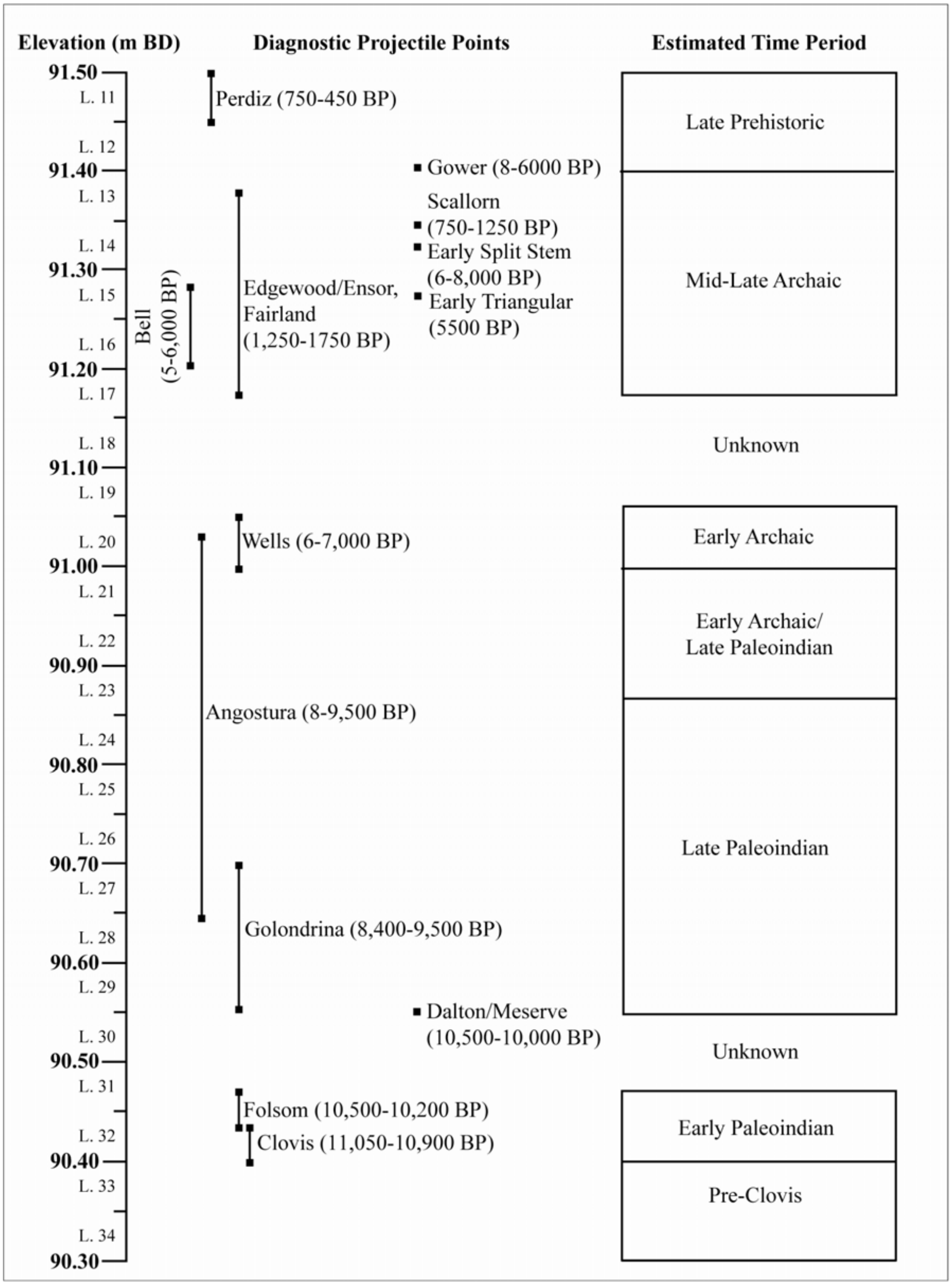

Figure 4.1. Diagnostic projectile points from Block A and estimated cultural periods.

1300N/1355E). Two thicker lanceolate biface fragments were found and are considered to be Clovis-like (see Appendix B Figure B.1 d and e for illustrations), though they lack apparent fluting. These occur within approximately 4 cm of each other at levels 32a and 32b of the same unit.

The majority of diagnostic points from Block A are in stratigraphic order with a few exceptions. The upper 30 cm of deposition has a mixture of point styles ranging from late prehistoric to Early Archaic in age. This could be caused by mixing due to plow-zone disturbance. This may also be the result of recycling of older materials by subsequent populations, or the relocation of older materials from upslope by colluvial or alluvial processes. One Early Archaic Martindale point (AM 4833-1) was found 10 cm below the Clovis component, though it was clearly located in disturbed sediments in a large burrow or pit located in the eastern sidewall of unit 1305N/1358E in Block A. Future excavations will hopefully fill in gaps in these dates. Future publications will compare diagnostic points with OSL samples collected throughout the profile.

Discussion

While some mixing seems to have occurred in topmost 30 cm, the early Archaic/Paleoindian points group very tightly and are in good stratigraphic order. The clustering of like-diagnostic types at similar elevations, and the grouping of said types in chronological order suggest very little vertical movement due to pedoturbation. This also indicates that the original ground surfaces below level 20 was almost completely flat. Artifact concentrations also occur an additional 20+ cm below the Clovis and

Folsom horizons and have no diagnostic artifacts. Diagnostic artifact distribution suggests that this lower horizon of materials may be in-situ as well. The next section uses size-sorting of all lithic materials to better understand the context of these archaeological horizons.

Size Sorting and Distribution of Archaeological Materials

Predictive models of pedoturbation within vertisols (Wood and Johnson 1978; Yaalon and Kalmar 1978) suggest that vertical movement will affect different size categories of clasts to different degrees (i.e., that large materials will move upward and smaller materials will fall down into narrow cracks and krotovina). If this is the case, then a shift in size distribution of all archaeological materials should be apparent with depth. Namely, deeper units should have a greater quantity of smaller artifacts compared to shallower units. Size distribution with depth should also indicate at which depth artifact concentrations no longer represent intact occupation surfaces, but are instead the product of contamination from higher levels. Finally, if mixing is minimal, it should be possible to identify occupation surfaces as peaks in artifact quantities and lulls as levels with skewed artifact size distributions.

Methods and Results

The dataset used in this paper consists of a total of 9,801 lithic artifacts and flakes collected from the 2007 excavation of Block A at the Buttermilk Creek site (Table

4.3). Fifteen 1 m^2 units were excavated in 2.5 cm levels and screened through ¼" mesh. Within these units, methodical excavation began with level 27a at elevation 90.7 m B.D. and continued until sterile degraded limestone colluvium was reached (see Appendix A for further details on excavation and lab procedure). This analysis uses the southern 12 units (the northern 3 were excluded due to suspected sampling error). The lithic materials collected were then sorted using a series of geologic screens of the following sizes: size 1-3 is all materials greater than ¾" in diameter (1.875 cm), size 4 includes all materials between ½" and ¾" (1.25-1.875 cm), size 5 includes all materials between $^3/_8$" and ½" (0.95-1.25 cm), size 6 includes materials between ¼" and $^3/_8$" (0.625-0.95cm), and sizes 7 and 8 are all materials less than ¼" (0.625 cm). Sizes 7 and 8 were not used in this first analysis to avoid possible sampling error. A number of artifacts fell through the ¼" screen in the lab and were grouped into size 7, but this is not a statistically viable size class for this analysis because these artifacts should have passed through the ¼" screens used in the field. The size of this sample, therefore, is dependent more on the excavation and screening methods of individual excavators than on actual quantities.

After sorting, data from all 12 units were combined to provide a large enough sample to produce meaningful results. In addition, size categories 1, 2, and 3 were combined due to a very low sample size for each individually. To further strengthen this analysis, level 36a was used as a cutoff point, as this level consists of only 48 artifacts, and all following levels consist of much fewer materials.

The low frequency of artifacts at level 36 may not necessarily indicate that deeper occupation surfaces do not exist. In the 2007 excavation block, not all units reached sterile colluvium at the same level. Alluvial sediments were deposited in horizontal layers, even though the underlying degraded limestone colluvium slopes to the southeast. For this reason, the northwestern-most units began hitting sterile gravels at level 35a. By level level 36a, only units 1305N/1356-1358 and 1306N/1356-1358 were still producing archaeological materials. At level 37b, only units 1305N/1358E and 1306N/1358E had not yet reached colluvium. It is possible that these southeastern units have earlier episodes of deposition not represented in the rest of the block. Future

Table 4.3. 2007 Block A Artifact Counts by Level and Size Category

Level	Elevation B.D.[1] (m)	Size 1-3	Size 4	Size 5	Size 6	Total
27a	90.70-90.675	30	125	271	630	1056
27b	90.675-90.65	22	111	230	643	1006
28a	90.65-90.625	15	103	234	564	916
28b	90.625-90.60	11	85	208	622	926
29a	90.60-90.575	16	82	183	553	834
29b	90.575-90.55	15	83	172	424	694
30a	90.55-90.525	5	75	164	479	723
30b	90.525-90.50	20	79	176	439	714
31a	90.50-90.475	41	59	122	329	551
31b	90.475-90.45	4	46	115	313	478
32a	90.45-90.425	8	39	99	277	423
32b	90.425-90.40	6	25	96	246	373
33a	90.40-90.375	4	26	53	162	245
33b	90.375-90.35	4	19	39	166	228
34a	90.35-90.325	5	24	44	131	204
34b	90.325-90.30	1	5	32	103	141
35a	90.30-90.275	2	9	21	62	94
35b	90.275-90.25	1	6	19	55	81
36a	90.25-90.225	1	6	13	28	48
36b[2]	90.225-90.20	1	1	2	20	24
37a	90.20-90.175	1	4	1	12	18
37b	90.175-90.15	2	2	1	5	10
38a	90.15-90.125	0	0	2	7	9
38b	90.125-90.10	0	0	1	4	5

[1] *Represents depth below site datum*
[2] *Shaded levels indicate materials not included in analysis due to low sample size.*

size-sorting analysis will include units excavated in 2008 and possibly 2009 and will hopefully increase the quantity of archaeological materials available at these deeper levels sufficiently to allow relevant statistical analysis.

Quantities. After artifacts were sorted based on size category, a simple graph was produced showing quantities per level (Figure 4.2). Peaks in artifacts are shown at levels with matching diagnostic artifacts. For example, the peak in quantities shown at level 28 corresponds with a number of Golondrina-style points, while the next peak at 30a directly overlies levels with Folsom artifacts. This graph then shows a significant decrease in artifacts after level 32b, followed by a plateau at 34a which then drops off again around level 34b. From here on, artifact counts seem to dwindle. Overall, deposition is too slow and occupation too frequent to produce clear cultural horizons in the form of clear peaks and valleys in artifact quantities. However, size sorting can be used to determine at which point the presence of artifacts no longer represents an intact cultural episode. If it can be proven that artifacts are not shifting vertically, this would seem to indicate two “Pre-Clovis” horizons at levels 33-34 and possibly level 35 .

Size Sorting. The first step to determining if artifacts are moving vertically is to provide a relative comparison of size classes by level. This is shown with a simple line graph in Figure 4.3. According to this graph, the relative ratios of size categories fluctuate a bit with depth, but seem to maintain the same relative frequencies compared to each other.

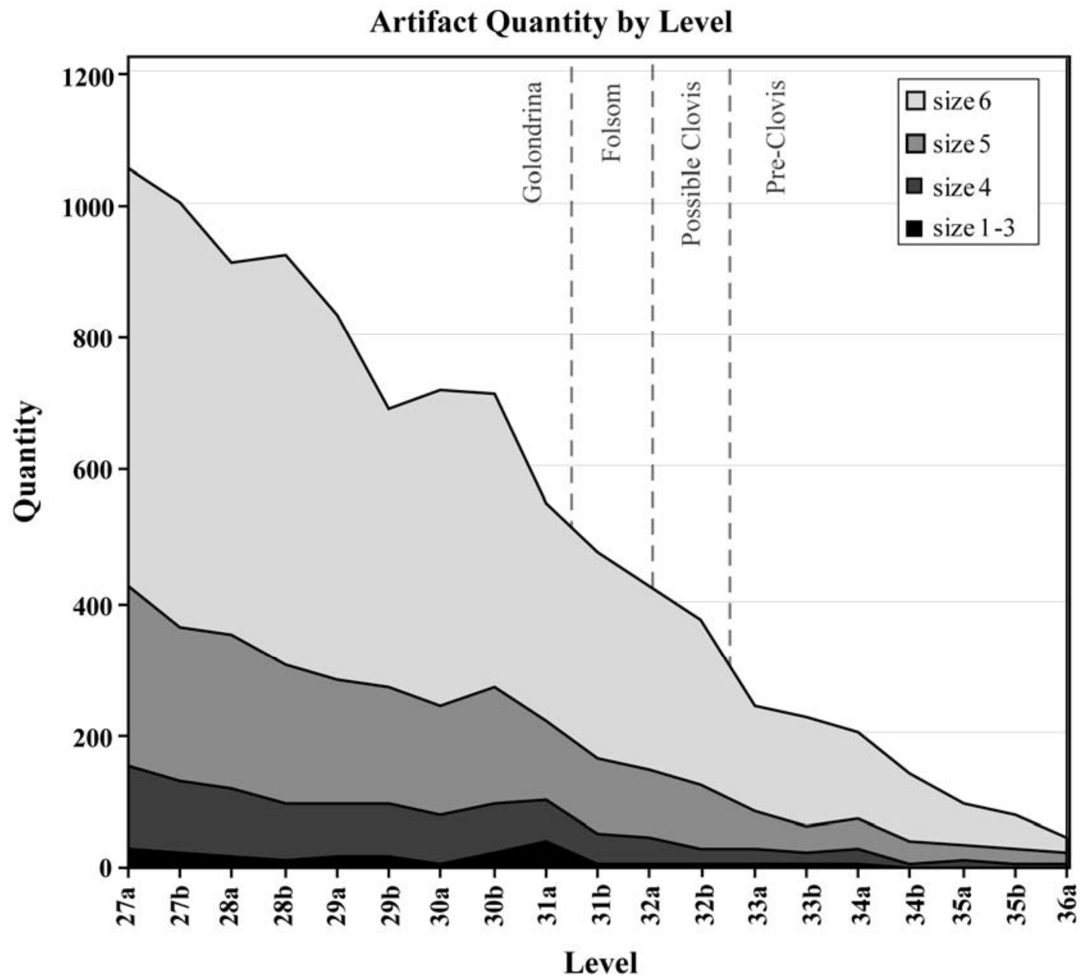

Figure 4.2. Artifact size categories: Quantity by level. Ages shown based on diagnostic artifacts

A better way to show the relationship between large and small artifacts is through the comparison of different size categories in a matrix, as shown in Figure 4.4. In this Figure, each graph represents a comparison of two size categories and quantities for each level (each represented by its own "+"). Essentially, this shows the how well quantities of each size class can predict the quantities of other size classes. The dotted line is a

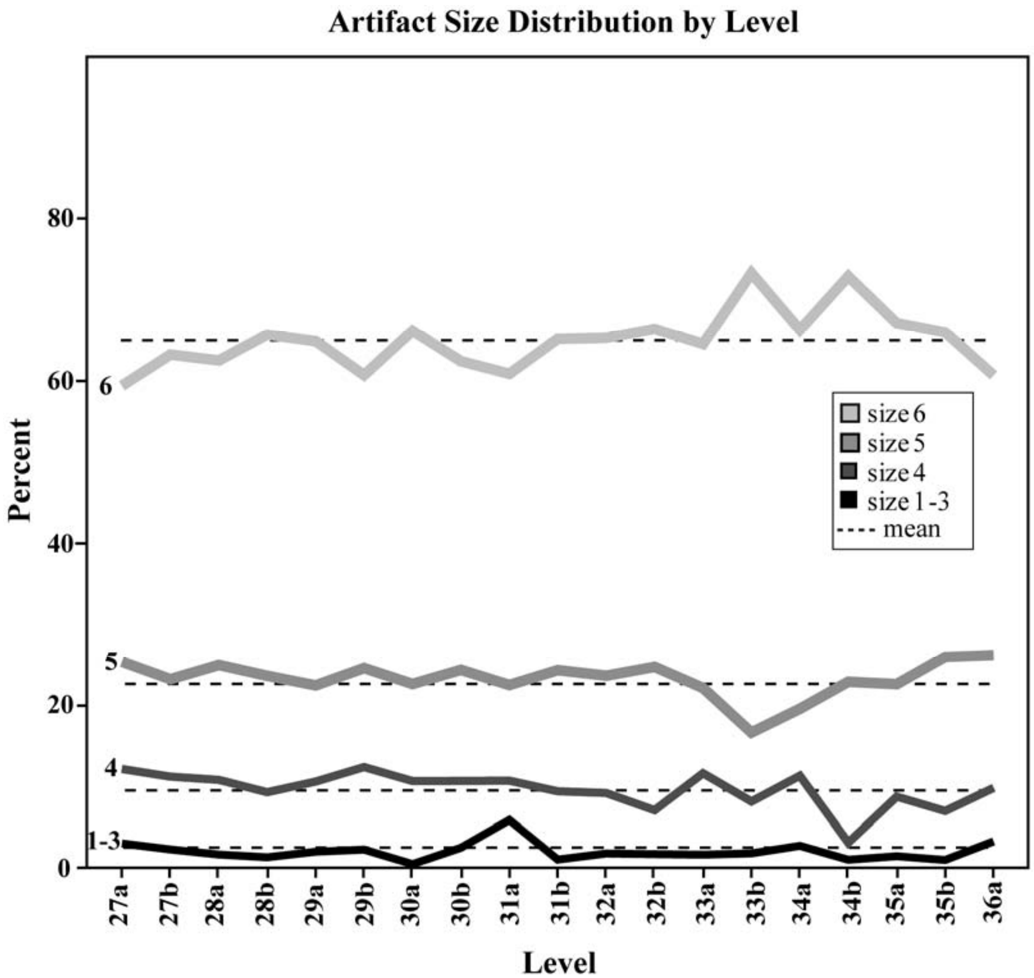

Figure 4.3. Artifact size categories: percent by level.

trend line showing the average correlation between the two. In this case, size classes 1-3 and 4 were combined to increase sample size enough to provide significant results.

All of these comparisons show a strong fit to the trend line, further suggesting that with increased depth, the ratio of large to small artifacts remains the same. One would expect to see deeper levels begin to skew away from the trend line in favor of the smaller size class 6 if vertical movement of cultural materials has occurred. However, these charts show no such trend. In fact, comparison of size 1-4 and size 6 shows a slight increase in the larger size class. See Appendix C for further detailed statistical analysis of size-comparison trends.

Figure 4.5 shows a three-axis ternary plot of lithic artifacts grouped into three sizes: large (sizes 1-4), medium (size 5) and small (size 6). The purpose of this diagram is to show whether materials trend toward particular size categories with depth. Points are color-coded based on theoretical time period (using diagnostic artifacts). All levels group in a fairly tight cluster with no more than 15% difference in any direction. Within this cluster, there may be a slight trend towards smaller artifacts (size 7), though there is a lack of any clear trend. It is possible, however, to identify a few outliers. Levels 33b and 34b, for example, show an especially high ratio of small artifacts, while 31a has a higher percentage of larger materials (size 1-4). Larger materials in level 31a may represent a specific lithic reduction episode while levels 33b and 34b may represent hiatuses in occupation in which the only artifacts found were small materials that shifted vertically slightly.

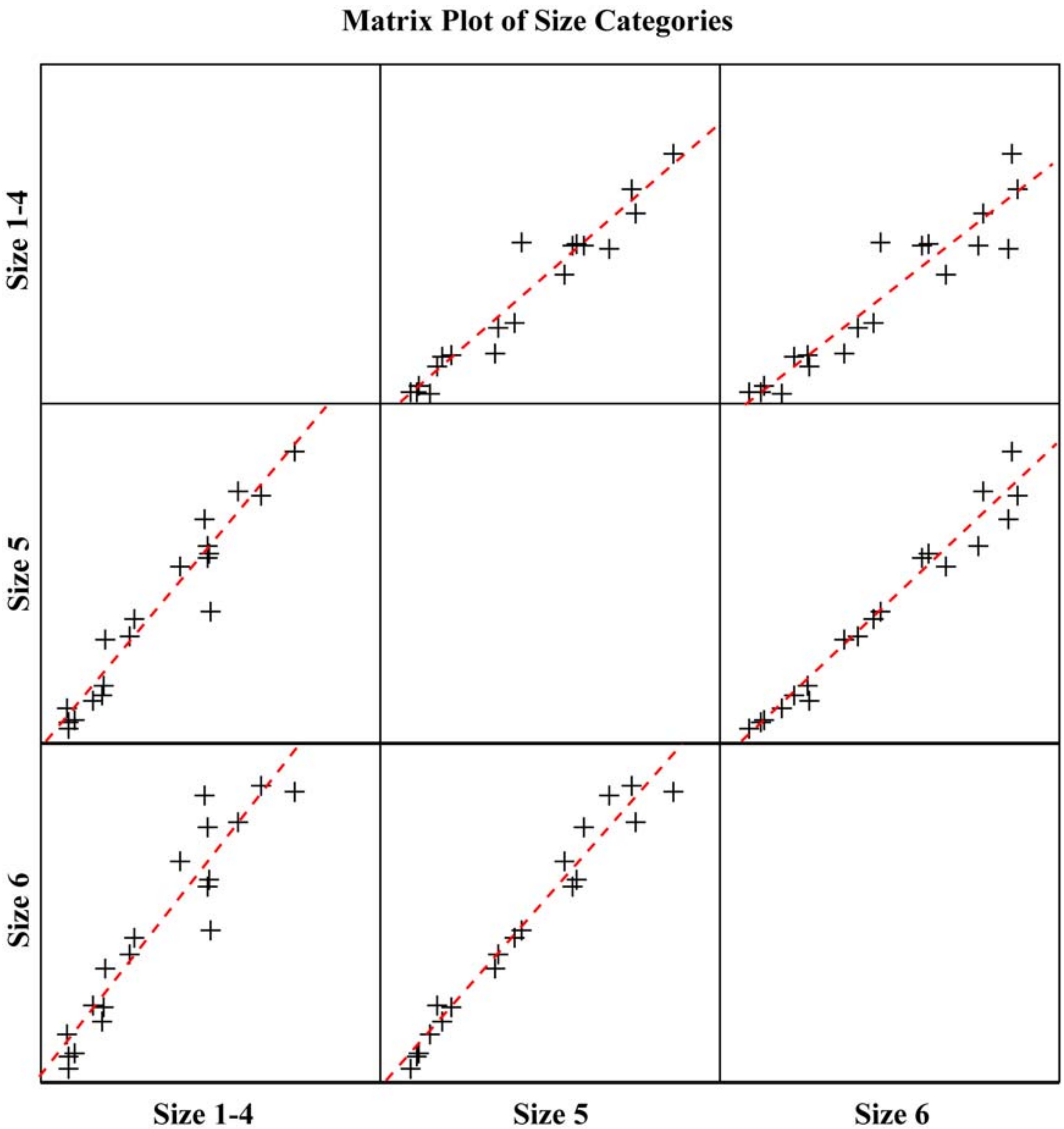

Figure 4.4. Matrix comparison of size categories of artifacts from Block A.

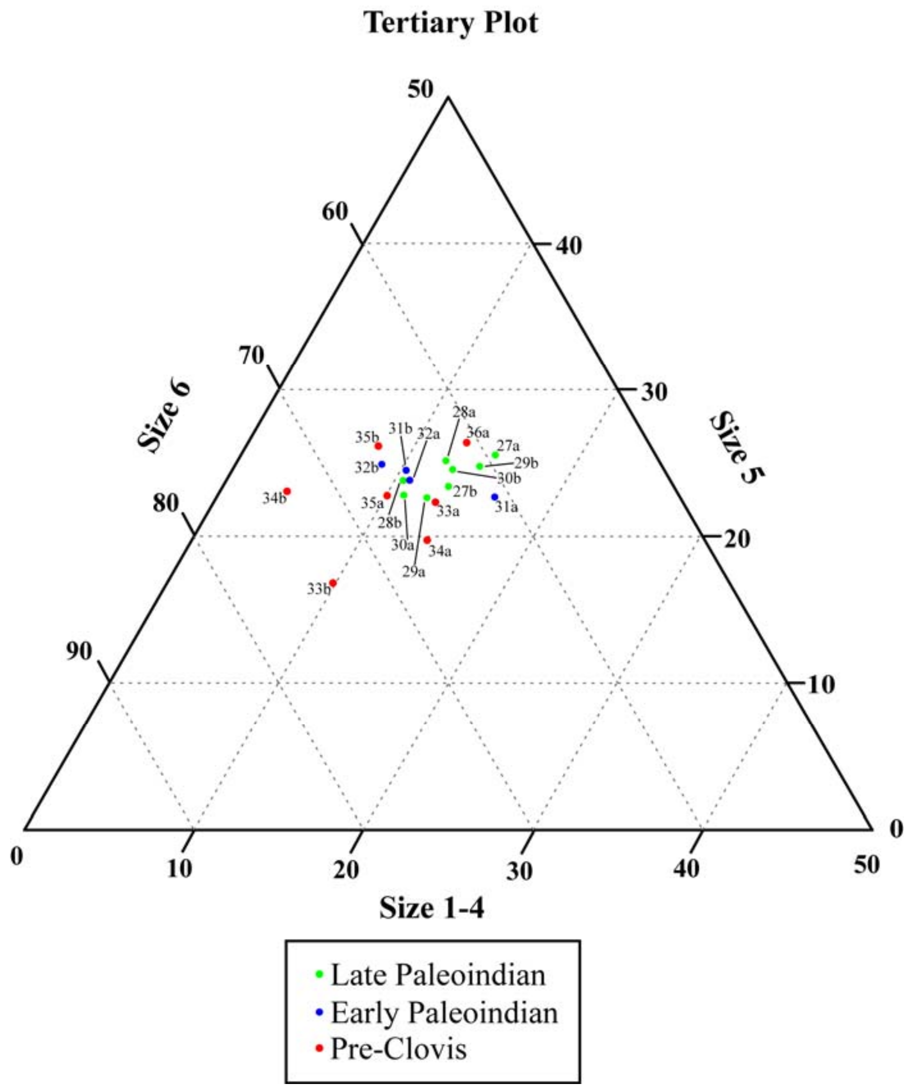

Figure 4.5. Ternary plot showing distribution of small, medium, and large artifacts.

50-by-50 cm^2 unit and Size Class 7. As mentioned earlier, the previous analysis ommitted size category 7 due to the potential for sampling error. However, two 50-by-50 cm^2 units located in a microtopographic high and a microstopographic low, were excavated at 1304N/1356E and 1304N/1358E (Figure 3.4) and were screened through 1/8" (0.3125 cm) mesh in the field, making size class 7 (1/8"-1/4", 0.3125-0.625 cm) possible to analyze. Size class 8, however, was not included since it would be prone to the same potential sampling error as size class 7 materials from the ¼" screened sample since anything less than 0.3125 cm in diameter should have fallen through the screen in the field. Size sorting results from one of these units (1304N/1356E) including size class 7 are shown in Figure 4.6. These results seem to show a slight increase in size class 7 over time, beginning around level 32. This appears to indicate that this smallest size

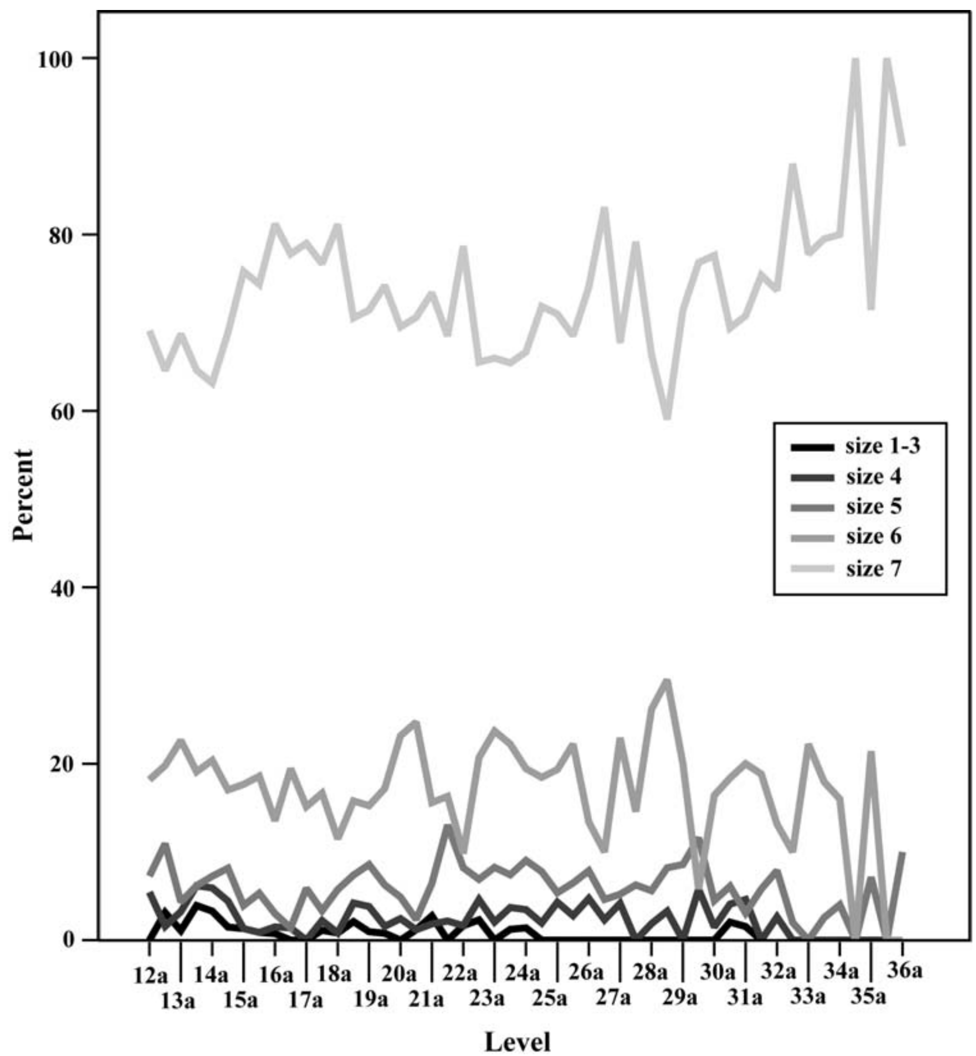

Figure 4.6. Artifact size categories from 1304N/1356E 50-by-50 cm^2 unit: percent by level.

category is moving vertically to a certain degree, especially in level 34b, though further analysis with a larger sample size is necessary to verify these results.

Archaic Versus Paleoindian Materials. To address the possibility that materials could have contaminated all of the Pleistocene levels from the shallower Archaic and late prehistoric surfaces, it is necessary to compare size sorting throughout the profile rather than just the Pleistocene levels shown above. While 2007-2008 excavations removed most Archaic sediments with minimal artifact collection, the four units excavated in 2006 were excavated in 10 cm levels and screened through ¼" (0.625cm) mesh.

Size sorting of the 2006 materials shows a similar trend in materials throughout the Archaic and Paleoindian levels down to around level 34. Level 35-36 shows a minor increase in the ratio of smaller artifacts, which basically conforms with the analysis of 2007 materials (see Figure D.1 in Appendix D); however, these units were excavated in 10 cm levels instead of 2.5 cm levels and with less accurate excavation methods. More intensive excavation and analysis of Archaic sediments at Block A is necessary to better understand artifact movement in the upper 65 cm.

Discussion

Very consistent size distribution with depth suggests very little vertical movement of archaeological material with the possible exception of size class 7. Though current information for size class seven is based on a small sample size, it appears as though it may be moving vertically, most likely through the very narrow (1-

5mm) cracks found in these deeper levels. Lack of change in distribution of any other size categories as deep as level 36a suggests that vertic processes are playing a minimal effect on the vertical distribution of archaeological materials.

While peaks and hiatuses are not clear in the quantity plot (Figure 4.2), minor peaks can be identified at levels 28, 30, and 32 (Figure 4.3), corresponding with concentrations of diagnostic artifacts. Furthermore, possible hiatuses in occupation at levels 33b and 34b, as well as a concentration of large materials in level 31a (Figure 4.5), suggest changes in occupation with depth. These factors may even be the result of behavioral factors affecting the archaeological assemblage. This provides further evidence that mixing processes are minimal, because mixing would have obliterated and homogenized archaeological horizons. Future analyses of these occupation surfaces could provide useful information regarding the behavior and technology of initial populations living in the Americas.

Size Sorting and Distribution of Non-Cultural Lithic Materials

Artifact size distributions were compared with the size distributions of a sample of non-cultural lithic materials from the two 50-by-50 cm^2 test pits excavated in Block A in 2008 (see Figure 3.4). The objective of this analysis is to evaluate the contention that materials are only minimally affected by vertic processes at Block A. If mixing processes were extreme, then it would be expected that the relative distribution of different size categories of artifacts would parallel the distribution of non-cultural rocks and gravels. If mixing is minimal, however, it is expected that this distribution will vary greatly from that of cultural materials since the depositional processes that deposit intact cultural horizons should differ greatly from colluvial episodes or post-depositional movement of materials. Furthermore, this analysis could provide useful information on the depositional and post-depositional nature of the sediments at Block A.

Methods

A sample of non-cultural lithic materials were collected from two 50-by-50 cm^2 units (1304N/1356E and 1304N/1358E) during the summer of 2008. These materials consist almost exclusively of limestone. Levels were excavated from the surface in 2.5 cm increments (level 12-14) down to archaeologically sterile colluvium at level 37. All sediments were water screened through 1/8" (0.3125 cm) mesh and all remaining materials were collected. Materials from one of these units (1304N/1356E) were then size sorted in the lab using the same criteria as the cultural material size-sorting analyses mentioned earlier. In this case, size classes 1 through 7 were used and size class 8 was not used due to possible sampling error. Each category for each level was weighed and bagged separately. In addition to weighing, debitage and tools were counted so that it may be comparable to artifact distributions from the 2007 excavation size-sorting analysis. These counts, however, cannot be compared with non-cultural rock quantities that were only weighed and not given exact counts.

These materials were then sorted into three categories: rocks, lithic artifacts, and calcium carbonate nodules (see Appendix A for more information and forms used). The primary focus of this analysis was on the distributions of rocks and artifacts. $CaCO_3$ was kept separate because it tends to form in place as a result of chemical leaching of carbonates from high levels and the subsequent accretion of carbonate in place at deeper levels around small grains. This could skew the data since $CaCO_3$ can form in place without any sort of vertical or horizontal movement, erosional episodes, or cultural interactions.

Results

Initial quantity distribution shows generally the same trend between cultural material and rock weights, with a high peak in the initial levels followed by a severe drop, a gradual increase peaking around levels 22-25, and a gradual decrease following this (Figures 4.7 and 4.8). This could possibly indicate the effect of depositional and erosional episodes on deposited materials, or may even be indicative of vertical mixing. On the other hand, these Figures also show how artifact quantities trail off with depth, but rock quantities seem to increase.

To better understand what processes are effecting these materials, comparisons of the size classes themselves is necessary. Contrast between rock and artifact distribution by size, however, shows little correlation between the two. Figures 4.9 and 4.10 show the total weights for each size class (with all levels combined). While the total weight of debitage decreases with decrease in size, the total weight of rock generally increases with decrease in size.

A more telling method for comparing size classes between artifacts and non-cultural material requires comparison of each size class using scatter plots. Each graph in Figure 4.12 shows a comparison of rock weight (x-axis) and artifact weight (y-axis) for each size category. This quantity is given in percents for each level so that actual distribution can be measured without results being skewed by changes in total weight from level to level. In these graphs, each dot represents a level from the 1306N/1356E 50-by-50 cm^2 sample. Fit lines show the degree of correlation between the two, and R^2 values show how well the fit line can predict artifact weight based on rock weight. An R^2 value close to 0 means there is no correlation while a score of 1.0 shows perfect correlation. Generally, a value of over 0.5 is necessary to indicate a possible trend. None of these graphs shows any clear trend. Size class 7 comes closest with an R^2 value of 0.253. The rest of the graphs show R^2 values of less than 0.15, suggesting that no discernable correlation exists between rock and artifact size categories in the 1306N/1356E 50-by-50 cm^2 unit with the possible exception of size class 7.

Discussion

Comparison of cultural and non-cultural lithic materials from the 1306N/1356E 50-by-50 cm^2 unit seems to show little correlation between weights of specific size classes. In addition, percentage ratios of size categories also show a lack of correlation with depth, with the possible exception of the smallest size class: 7. While the trend line shown in this comparison (Figure 4.11) is still not definite, it seems to show a certain

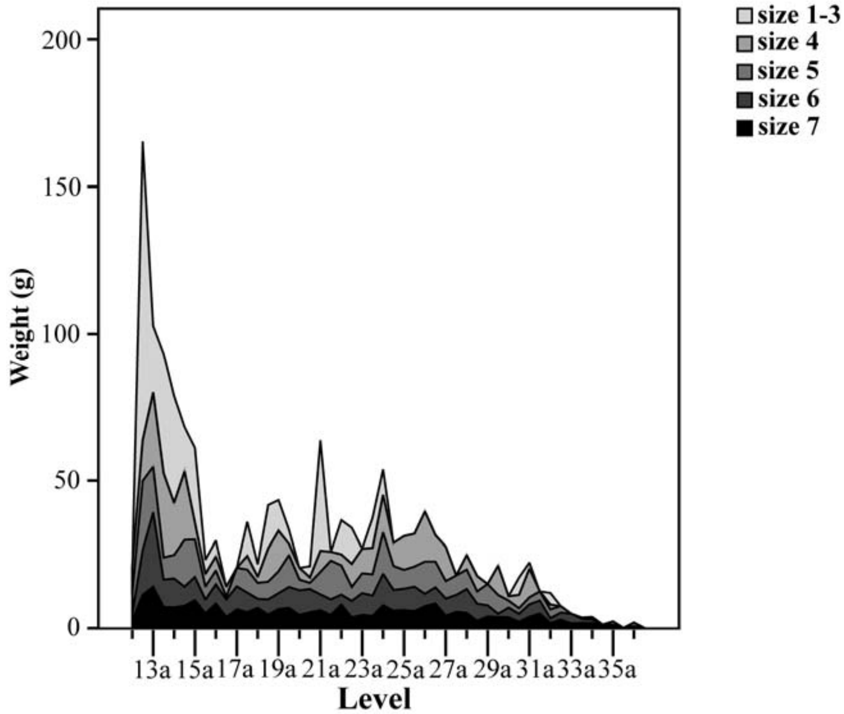

Figure 4.7. Artifact quantities by level and size class.

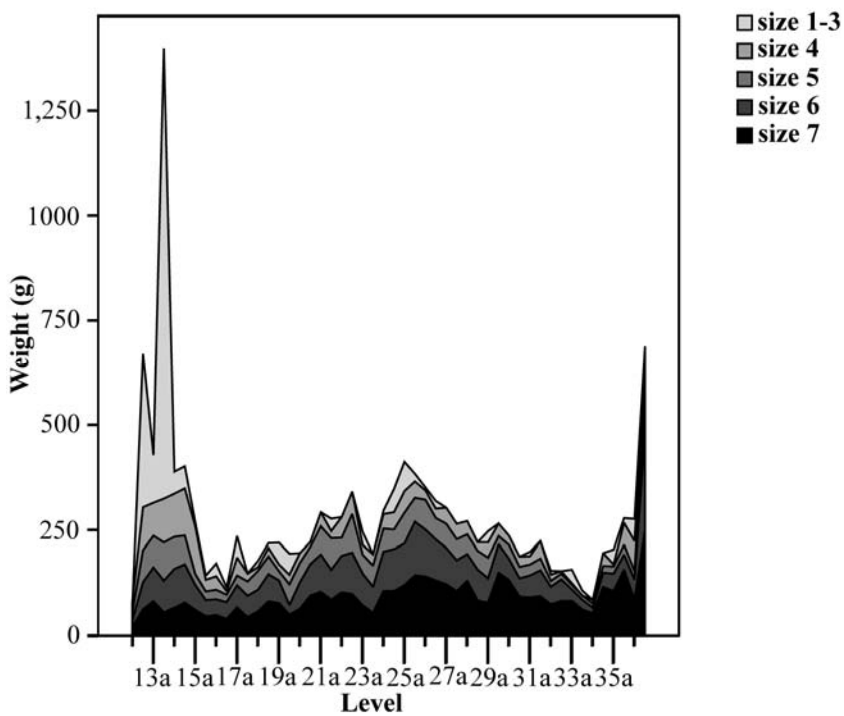

Figure 4.8. Rock quantities by level and size class.

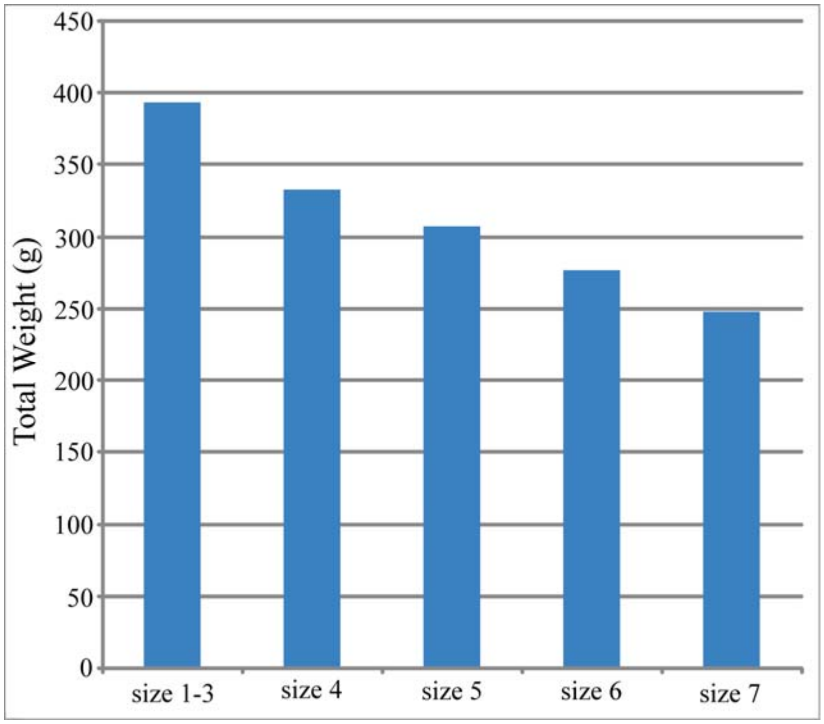

Figure 4.9. Total weight of debitage by size class in 1304N/1356E 50-by-50 cm^2 sample.

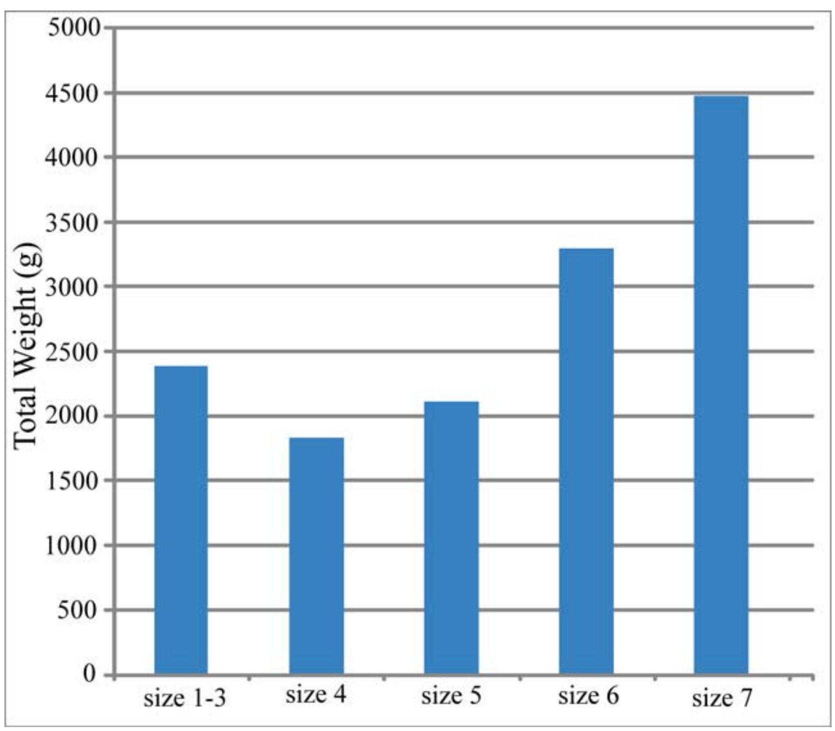

Figure 4.10. Total weight of rocks by size class in 1304N/1356E 50-by-50 cm^2 sample.

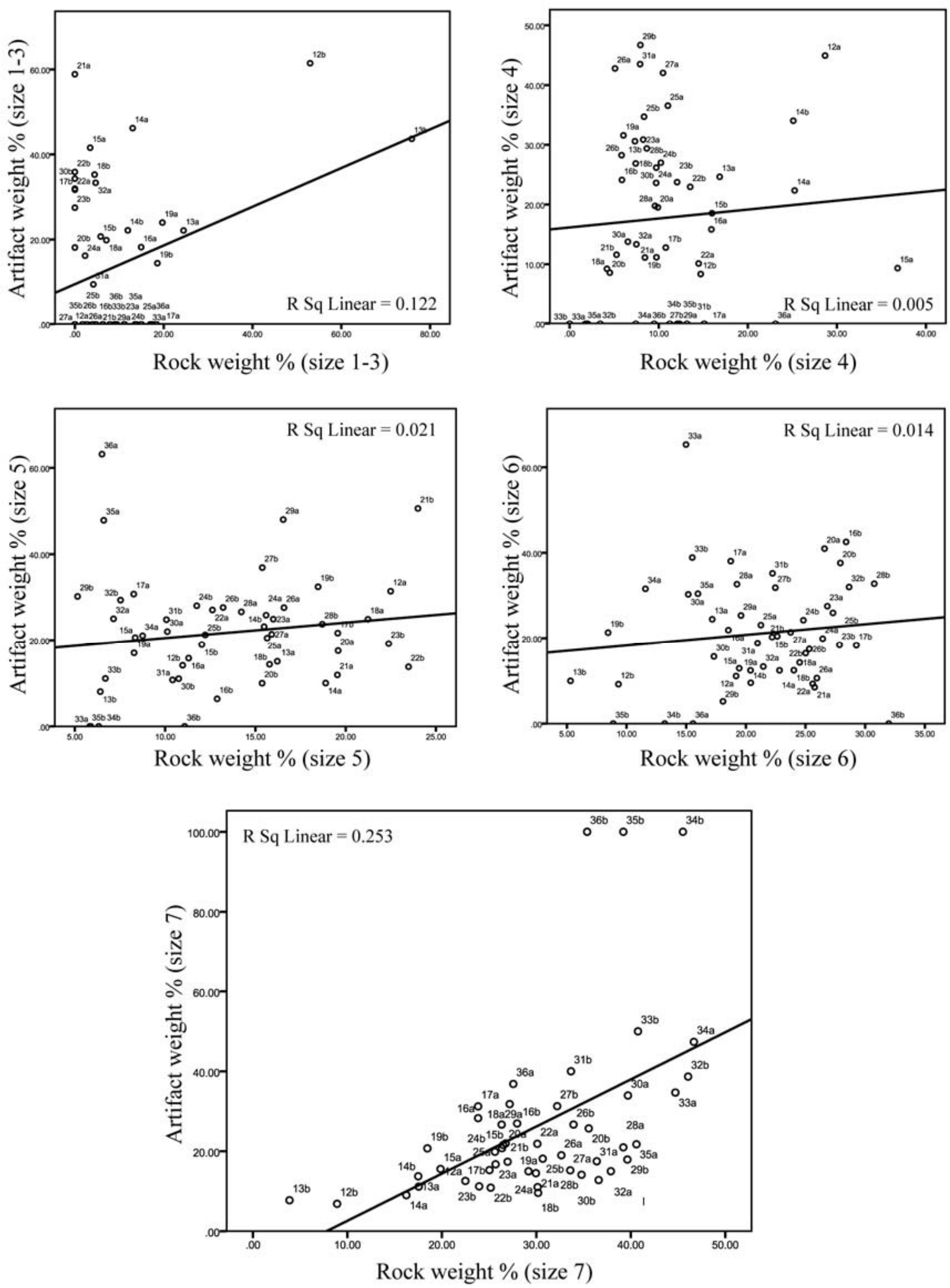

Figure 4.11. Scatterplots comparing percentages of material (by weight) between rocks and artifacts. Fit lines and R^2 values show degrees of correlation

degree of correlation between ratios of size class 7 weight between rocks and artifacts with depth. This may indicate that these smallest materials are moving vertically while larger materials are remaining in place. This is by no means a definitive result, as the sample size is so small and in such a localized area. However, judging by these results and the count ratios shown in Figure 4.6, it remains a distinct possibility that some of the smallest materials may be out of context. To better understand this trend, future excavations will need to screen a more substantial quantity of materials through 1/8" screen rather than ¼". This will provide a large enough sample to perform a statistically relevant analysis of size-sorting data for the Archaic as well as the Paleoindian cultural materials at Block A. Future studies will be able to use these data to determine if mixing is occurring in the Archaic levels and to what extent, as well as provide further insight into whether Archaic materials may be contaminating deeper occupations.

It is also worth noting that increases in the quantity of rocks beginning with level 20 and peaking in level 26 correspond with the seemingly rapid deposition of materials during the Angostura period in which gravels were re-deposited here from upslope. This may indicate some sort of colluvial depositional episode during this period. Future OSL dating of Block A will provide a more detailed depositional record that may then allow a comparison with climatological records.

Maps of Artifacts and Disturbance Features

Maps of soil changes, cracks, krotovina, and mapped artifacts were created in the field at 5 cm intervals corresponding with the bases of each 5 cm level beginning with level 30. Each of these maps was combined together to produce a comprehensive map of disturbances and mapped artifacts for Block A units excavated in 2007 and 2008 (see Appendix E for complete level maps). The purpose of this analysis is to better understand the distribution of clay cracks at deeper levels (approximately 90-130 cm below surface) and how they correllate with the location and densities of artifacts. Specifically, this analysis will help determine to what degree artifacts at deeper levels correspond with cracks and krotovina.

Results

Distribution maps show a decrease in the frequency of cracking with depth. In the 2007 excavation area, cracking at level 30 is almost completely absent with the exception of unit 1305N/1358E which seems to be part of a concentration of deep, densely conFigured cracks in the eastern portion of the block that crosses units 1303N/1359E, 1304N/1359E, 1305N/1359E and 1305N/1358E. Despite a lack of cracking in the rest of the 2007 units, piece-plotted artifact concentrations persist through level 34. While the 2008 excavation seems to have a greater frequency of cracking, most mapped artifacts still do not correspond with cracks or krotovina until level 37a in which it is apparent that the majority of the few remaining mapped artifacts are located in krotovina.

It should be noted that the 2008 excavation stopped at the surface of colluvial gravels between levels 37 and 42. This surface was covered in a layer of large cobbles that rested directly on the colluvium (see final map in Appendix E). This contradicts the idea proposed by Wood and Johnson (1978) that shrink/swell forces lift large cobbles up to the surface. This lack of uplift of cobbles may be further indication of a lack of vertic mixing processes at Block A.

Heat Alteration of Archaeological Materials

A substantial quantity of the lithic materials at Block A shows obvious signs of heat-alteration; however, a lack of distinguishable hearth features prevents the identification of specific occupation episodes. Presence of burning at higher concentrations at certain depths may be indicative of different occupational or depositional episodes with the possibility of differing activities taking place. Because mixing vertic processes would homogenize archaeological materials, successful identification of differing degrees of burning may indicate a relatively low degree of vertical movement.

Methods

Artifacts from levels 27a through 36a from four sample units (1305N/1355E, 1305N/1356E, 1305N/1357E, and 1305N/1358E) were examined and sorted into two groups based on the presence or absence of heat alteration. Easily identified criteria such as potlidding, crenelation, and crazing as defined by Purdy (1975) were used to determine whether or not an artifact was exposed to extreme heat. Artifacts were also grouped into absence/presence of burning categories for each size class in order to determine whether certain size classes had different degrees of burning (see Appendix A for forms and lab).

Results

Figure 4.12 shows that percentage of heat alteration remains somewhat consistent with depth, though certain levels (28a, 30a, 31b, 33b-34b) show slightly higher percentages of burnt materials. For the most part, these fluctuations are minimal and do not provide strong evidence for differences in burning with depth. However, the correspondence of a larger spike in burnt materials between levels 33b and 34b corresponds with a subtle change in the distribution of artifact size classes as shown in levels 33b and 34b. Figure 4.13 shows a similar chart in which total quantities of burnt artifacts are shown. Again, each size class contains comparable percentages of heat-altered artifacts for most of the profile with the exception of an increase in the percentage of smaller materials (sizes 5 and 6) with signs of burning at levels 33a through 34b. It is interesting to note that while size classes 5 and 6 increase in percentage in Figure 4.12, size class 1-4 stays relatively the same until level 35a.

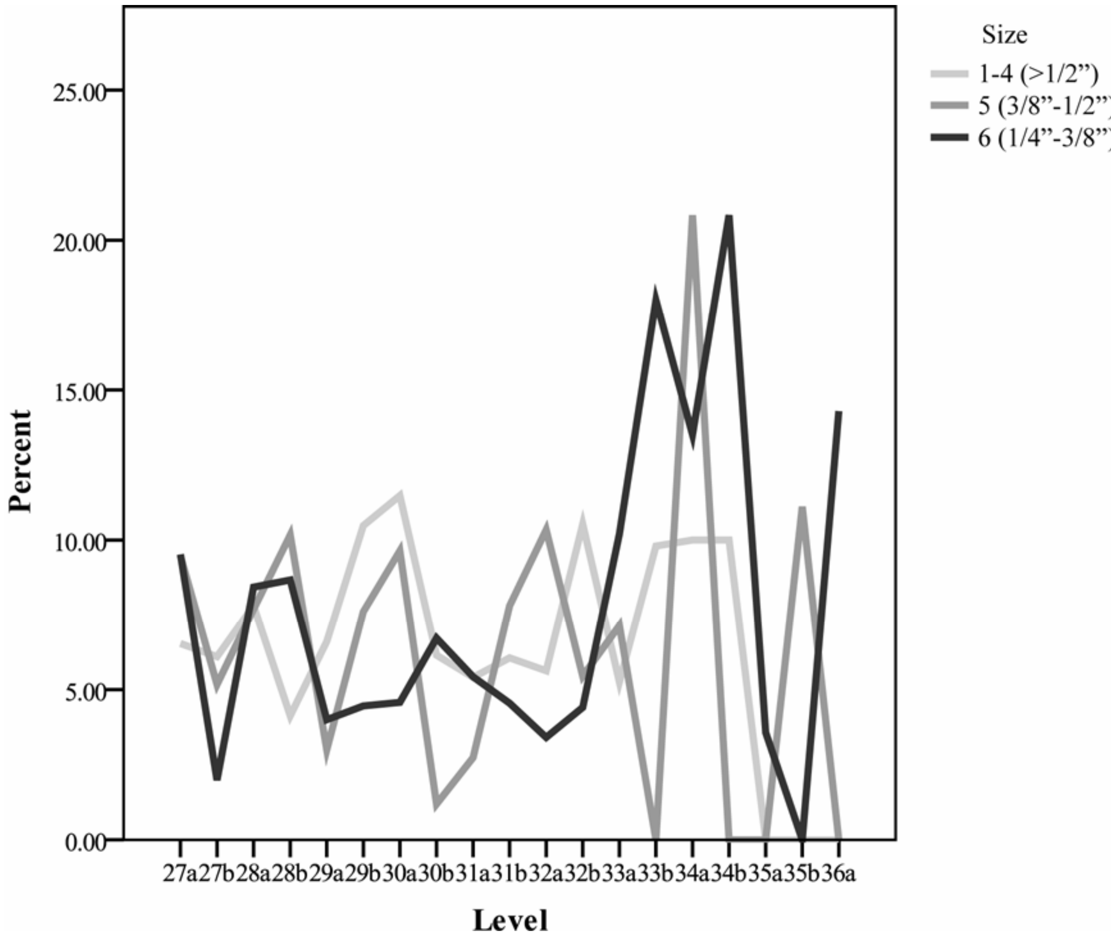

Figure 4.12. Percentage heat altered artifacts from each size class by level

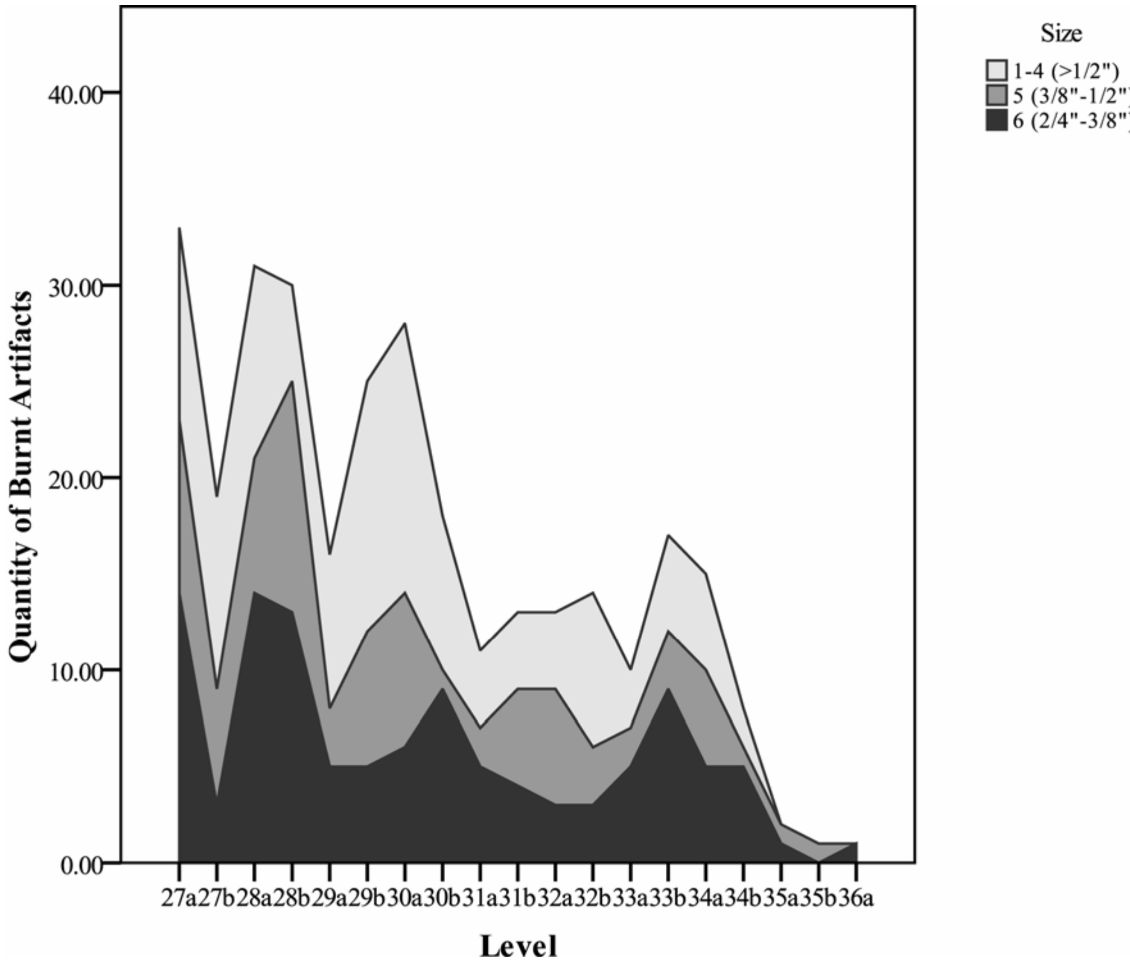

Figure 4.13. Distribution of heat altered artifacts by size class

Conclusions

These distributions show a lack of distinct patterning both with depth and between size categories. Each size class has similar percentages of burnt artifacts, and each level has a low percentage of burnt materials with small peaks at certain levels. The peak in percentages shown at levels 33b-34b of smaller artifacts may be indicative of a larger ratio of displaced artifacts of smaller size while the percentage of larger materials remains constant, suggesting a combination of in-situ larger materials and displaced smaller materials. The sample size at this depth, however, is too small to come to any definitive conclusions. Burning was obviously present in all levels analyzed, but there are only weak concentrations at any particular depth. Further analysis with a larger sample size would do more to add credence to this analysis. Adding other defining characteristics for heat alteration such as discoloration or heat polish could potentially raise these percentages substantially, though these criteria were not used due to their subjective and non-replicable nature. The current data available remains inconclusive.

Presence of Calcium Carbonate

Calcium carbonate ($CaCO_3$) is abundant at Block A due to the high quantity of carbonates in the soil that leach out of limestone gravels. Initial soil analysis (Driese 2008) suggests that soils at the site are stable enough to allow leaching of carbonate from the upper levels and subsequent deposition in the lower levels in the form of skeletal grains and reprecipitated carbonate in the form of coatings on rocks and artifacts. The absence of $CaCO_3$ in upper levels suggests minimal amounts of pedogenic processes are mixing deep and shallow horizons. Conversely, if pedogenic processes are minimal, there should be increasingly higher presence of $CaCO_3$ with depth. This analysis seeks to further understand the distribution of calcium carbonate concretion on size-sorted artifacts in the early Archaic and Paleoindian horizons excavated in 2007.

Methods

Lithic artifacts from levels 27a through 36a for four sample units from the 2007 excavation of Block A (1305N/1355, 1305N/1356E, 1305N/1357E, 1305N/1358E) were used for this analysis. Materials were size sorted in the lab using size categories mentioned earlier (Table 3.1) and then categorized based on presence or absence of $CaCO_3$ concretions (see form in Appendix A). In addition, CaCO3 nodules were collected and weighed from each level of the 50-by-50 cm^2 unit at 1304N/1356E to see if a similar pattern could be seen.

Results

Figure 4.15 shows the percentage of total artifacts with $CaCO_3$ formation by level. Beginning at level 27a, percentages gradually increase with depth until they reach approximately 70% around level 31 where percentages level off. This compares well with the $CaCO_3$ weight distribution from the 1306N/1356E 50-by-50 cm^2 unit (Figure 4.15), which shows a complete lack of any $CaCO_3$ until level 26, followed by an increase with depth. Figure 4.16 shows the same distribution of $CaCO_3$ presence, only with separate lines for each size class. This shows the same trend of increasing $CaCO_3$ presence over time while also showing what percentage of each size class has $CaCO_3$ at each level. Figure 4.17 shows a gross distribution of $CaCO_3$ percentages by size class, indicating the increased presence of $CaCO_3$ on larger artifacts.

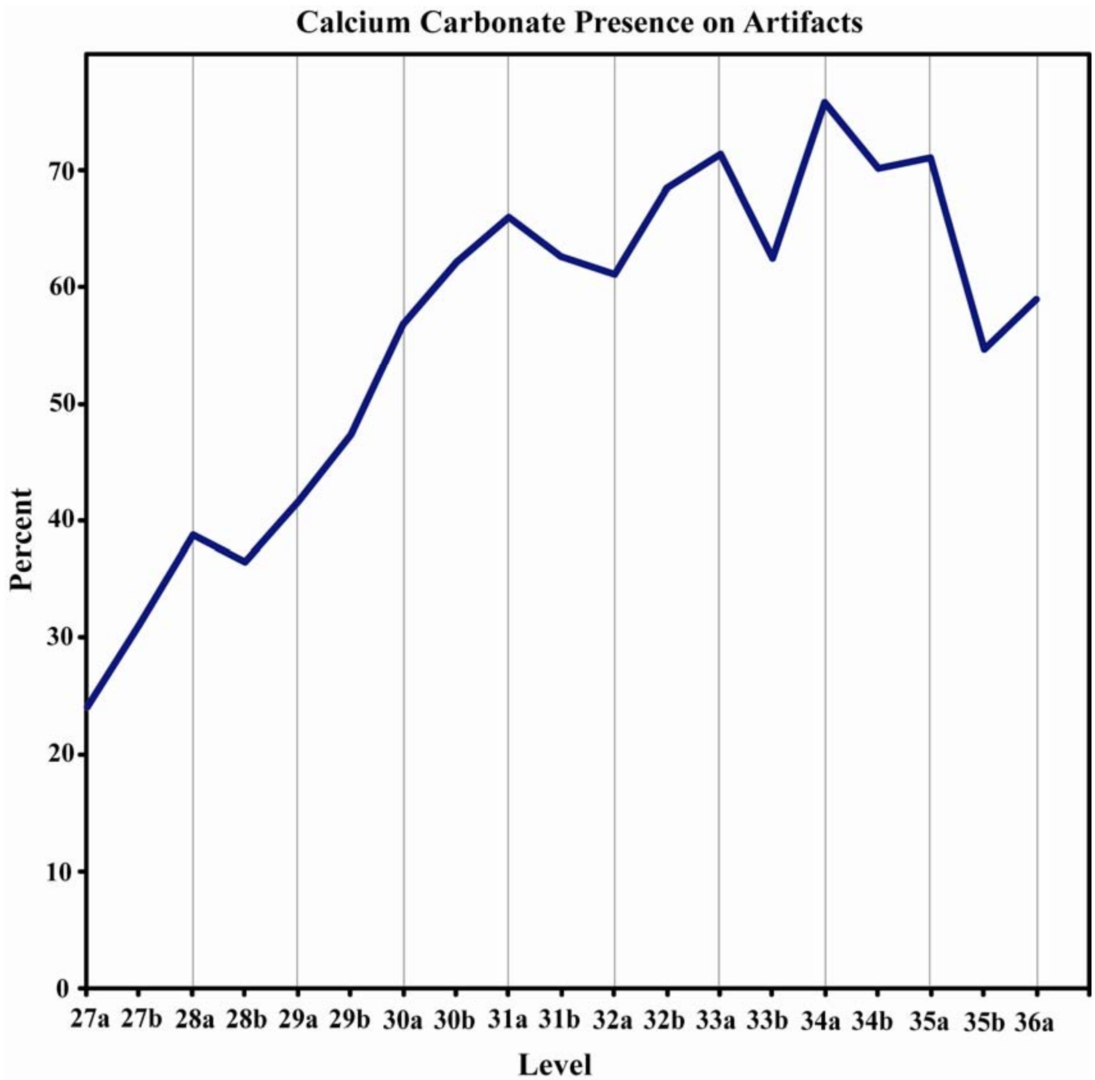

Figure 4.14. Percentage of artifacts with $CaCO_3$ presence by level from 2007 sample.

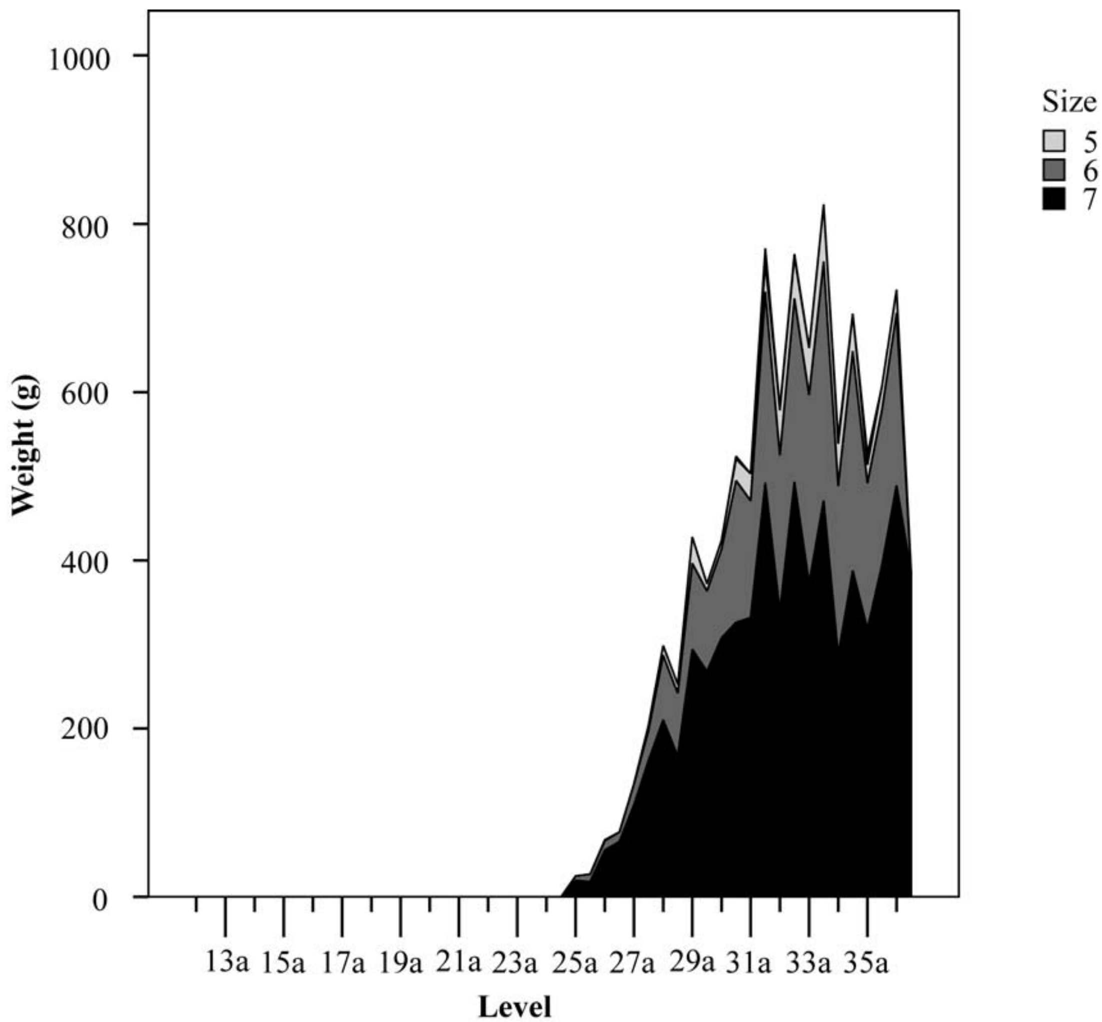

Figure 4.15. Quantities of $CaCO_3$ nodules by size in 1306N/1356E 50-by-50 cm^2 unit (2008).

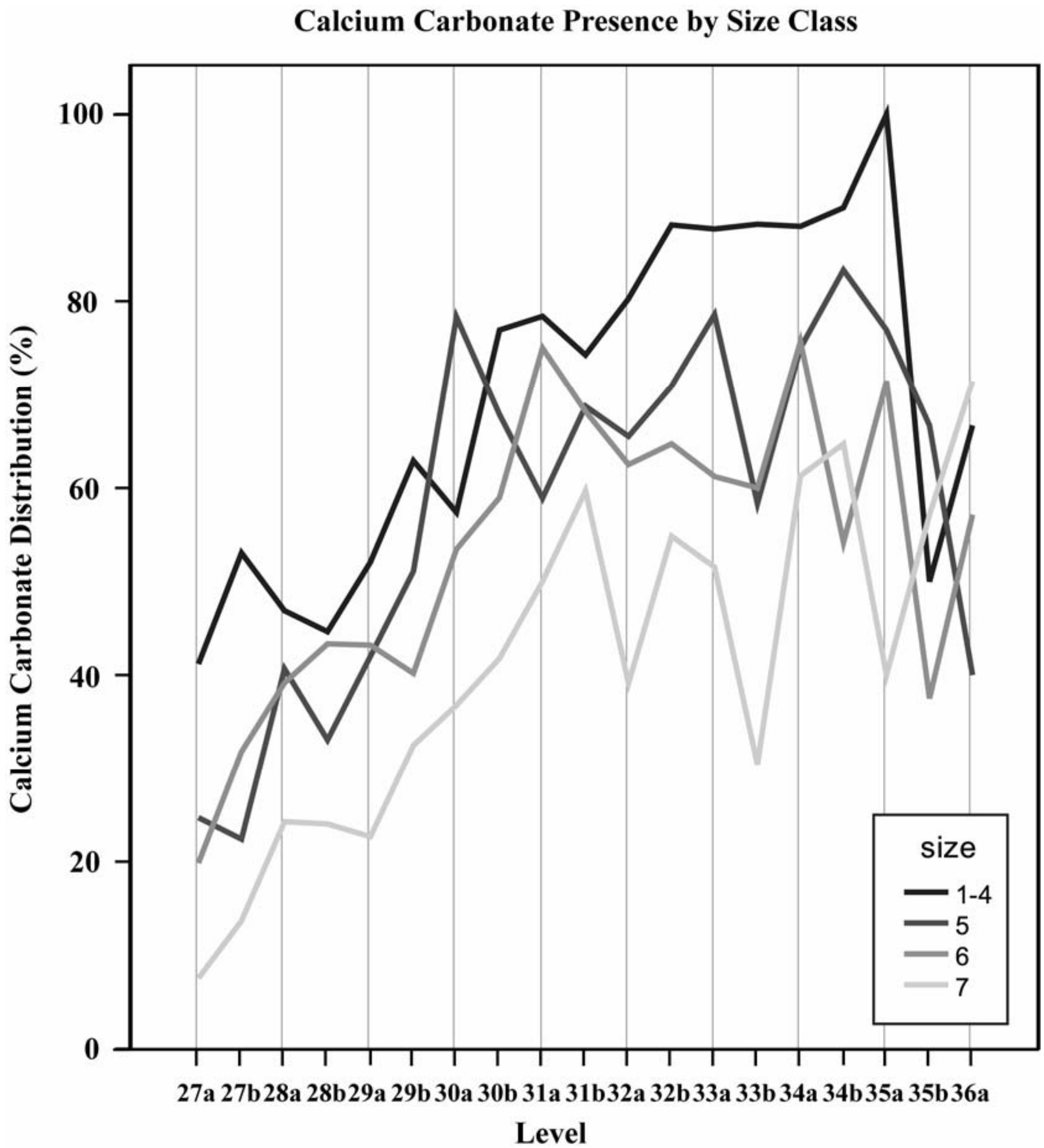

Figure 4.16. Percentages of artifacts with $CaCO_3$ presence by level sorted by size class from 2007 sample.

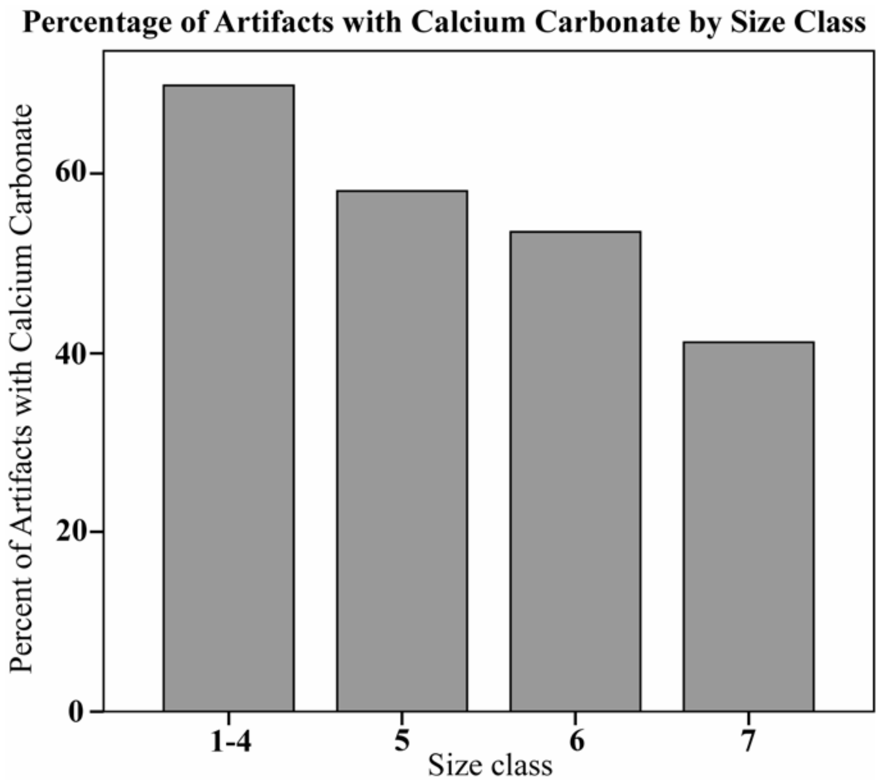

Figure 4.17. Distribution of artifacts from 2007 sample with $CaCO_3$ by size class (levels 27a-36a).

Discussion

The distribution of artifacts by size class seems to show that larger artifacts are more likely to have $CaCO_3$ coatings then smaller artifacts (Figure 4.17). While this may be an indicator of movement of smaller artifacts from above, this is more likely due to the fact that larger artifacts inevitably have more surface area, thus raising the odds that some amount of $CaCO_3$ will form and be recognized.

Overall distribution of artifacts with $CaCO_3$, however, provides more interesting results. Figure 4.14 shows a low percentage of $CaCO_3$ in shallower levels with a steady increase with depth before reaching a plateau at around 70%. This, combined with the

50-by-50 cm^2 results shown in Figure 4.15, shows that $CaCO_3$ is only forming in the deeper levels and that formation corresponds directly with depth below the surface. If mixing were a contributing factor to site formation, then calcium carbonate levels should be either uniform or random with depth as encrusted artifacts were moved upward or clean-artifacts were moved downward. Furthermore, Figure 4.16 shows that in deeper levels (30-35), the vast majority of larger artifacts (sizes 1-4 and 5) have $CaCO_3$ presence. The distribution shown here implies that deeper materials have remained stationary long enough for $CaCO_3$ to form through gradual chemical leaching processes and are therefore not moving substantially within the profile over time.

Summary

Analysis suggests that intact cultural horizons are present at Block A at level 34, with possible deeper occupations as deep as level 35 and 36a, though sample sizes for these levels are too low to make any conclusive statement to this end. Diagnostic artifacts found suggest a mixed “plow zone” in the upper 30 cm of sediment, under which early archaic and Paleoindian diagnostic artifacts are in chronological order with depth, suggesting relatively little vertical movement. Size sorting of all archaeological materials shows that relative proportions of large to small artifacts remains constant until 10-15 cm beneath the proposed Clovis-aged levels (32a and 32b), indicating cultural horizons pre-dating Clovis. In addition, size sorting of cultural versus non-cultural materials shows little correlation, suggesting that the processes moving non-cultural debris within the profile are different than those affecting artifacts, with the possible exception of the smallest of archaeological materials in size class 7 (artifacts less than 0.625 cm in diameter). Level maps of sediment disturbances show that in the Paleoindian aged levels (based on diagnostic points), have few narrow cracks of between 1 and 5 mm in width, which may explain why only the smallest archaeological materials show signs of movement. Analysis of heat-altered artifacts was somewhat inconclusive, though a relative increase in smaller artifacts with signs of burning in relation to larger artifacts at level 34 may suggest a downward mixing of only very small artifacts from the burnt archaic midden above. Finally, $CaCO_3$ presence on artifacts and in the 50-by-50 cm^2 sample strongly suggests that the Paleoindian component at the site underlies the area of substantial vertic movement of materials. Furthermore, complete lack of $CaCO^3$ above level 25 and a steady increase with depth below level 25 suggests little mixing of these two zones.

CHAPTER V

DISCUSSION AND CONCLUSIONS

It was once assumed that the defining characteristic of vertisols was their tendency to constantly churn and mix sediments with shrink/swell forces and clay cracking, effectively destroying all horizonation, and therefore hopelessly mixing archaeological horizons along with it. Recent studies in the geological literature, however, provide evidence that all the features of vertisols can form without the prerequisite that these soils are constantly mixing. While evidence surely exists demonstrating that vertisols are capable of disrupting an archaeological site, the properties governing a particular vertisol can vary vastly over even very small distances. Extensive analysis of soils and cultural materials at the Buttermilk Creek site Block A show that, while sediments there have the properties of a vertisol, vertical disturbance at the site is minimal, making it possible to identify likely occupation surfaces.

Post-Depositional Processes at the Buttermilk Creek Site

Diagnostic Points

The vast quantity of diagnostic points found at the site from multiple time periods can be explained by Buttermilk Creek's proximity to one of the largest quarry sites in Texas. These artifacts provide convenient temporal markers, allowing one to grossly date different occupations at the site if in place, or recognize post-depositional disturbances if found in mixed chronological order. Results of the diagnostic point study show two trends at Block A:

1) The upper 30-35 cm (Levels 11-17) of sediments appear somewhat disturbed. This can be seen by a mix of late prehistoric, late Archaic, and early Archaic point forms in poor stratigraphic order (Figure 4.1). Point styles represented include two Perdiz, one Scallorn, three Edgewood, one Gower, one Bell, one Early Split-Stem and one Early Triangular form. This is likely the result of plow zone activity (Zone 1, Figure 2.2). While local land owners claim that this particular property was never plowed, all surrounding properties were plowed at some point, and the likelihood that this area was plowed in the past 150 years is high. Alternatively, mixing of older materials with newer may indicate the recycling/deposition of older materials picked up from other parts of the site by prehistoric populations. This mixing may even represent some shallow mixing due to pedogenic forces near the surface.

2) Numerous diagnostic artifacts found in levels 20 through 32 show a steady progression from younger to older point styles spanning the early Archaic and Paleoindian periods (Figure 4.1). Points found include two Wells, five Angostura, eight Golondrina, one Dalton/Meserve, three Folsom, and two possible Clovis bifaces. This pattern strongly suggests that occupations at these depths are in their original vertical context. This could be explained by their depth below the plow zone, as well as their proximity to the underlying degraded limestone and bedrock. Because soils require a minimum of 50 cm of clay-rich sediments with cracks extending at least 50 cm to become vertisols (Soil Survey Staff 1975), sediments at Block A may not have

developed vertic characteristics until, at the earliest, 90.70-90.80 cm below datum, or levels 25 and 26. It is more than likely that by the time substantial cracking or mixing really began, Paleoindian and very early Archaic sediments were already buried deep enough to be minimally affected.

Size-Sorting Analyses

Results from the size-sorting analysis of cultural materials provide additional support for these conclusions. Grouping artifacts into categories based on size and charting changes with depth provides a means of seeing if materials are drifting down narrow cracks and small krotovina. This is based on the assumption that these narrow openings will favor the movement of smaller materials. Increases in concentrations of small artifacts compared to large artifacts should be indicative of out-of-context materials rather than an intact occupation surface. This analysis produced the following results:

1) Ratios of large to small artifacts remain constant with depth throughout the vast majority of the levels analyzed (27 through 36a), with the possible exception of levels 33b and 34b, which show a decline in the ratio of large materials to small (Figures 4.3 and 4.5). Based on this analysis, in-situ cultural materials exist through level 34, and may also occur in deeper levels 35a, 35b, and 36a, though low sample size prevents a definitive conclusion on this deeper component at this point in time.

2) Samples of cultural materials collected from the 50-by-50 cm^2 unit at 1304N/1356E suggest a similar trend in larger artifacts. However, due to the finer

screening of these materials, it was possible to examine ratios of artifacts in size classes 1-7 instead of the 1-6 used in the rest of the 2007 materials. Results of this analysis show that, while larger size classes stay fairly consistent, size class 7 increases with depth. This correlates with the small size of cracks in the Paleoindian levels (less than 0.5 cm), implying that the smallest (<0.625 cm) materials may be moving downward through cracks. This is an intriguing development that requires further testing to verify.

Calcium Carbonate

Another useful statistic in this analysis is the tracking of $CaCO_3$ formation. $CaCO_3$ forms in deeper sediments, usually as a result of chemical weathering processes. Precipitation combines with atmospheric and soil carbon to form a weak carbonic acid, which then reacts with carbonates near the surface (in this case, colluvial carbonates and limestone gravels). Calcium and bicarbonate then dissolve into a solution which percolates down through the profile. Once a depth is reached where dry conditions persist, the carbonate precipitates, forming $CaCO_3$ in these deeper sediments (Salomons et al. 1978). In the 50-by-50 cm^2 sample, $CaCO_3$ nodules are completely absent in upper levels (Figure 4.16). Beginning with level 26, $CaCO_3$ increased dramatically before reaching a plateau around level 31. This same pattern can be seen on $CaCO_3$ formation on artifacts and flakes. Percentages are low at level 27 but increase with depth before reaching a plateau around level 31 where between 60 and 70% of artifacts all have some degree of $CaCO_3$ formation.

Tracking the degree of $CaCO_3$ formation with depth at Block A provides two interesting conclusions:

1) Because $CaCO_3$ forms at depths with relatively low levels of moisture content, shrink swell processes are minimal at these depths. This could explain why deeper materials show minimal mixing and less slickenside formation.

2) The complete lack of $CaCO_3$ nodules or encrustation on artifacts in upper levels further suggests that the "self plowing" processes described by Johnson (1972) are not taking place, as a constant churning of sediments would bring $CaCO_3$ up to the surface as well as bring un-encrusted artifacts downward, homogenizing concentrations to a certain extent. The apparent lack of this homogenization suggests that $CaCO_3$ leaching and formation far outpaces any mixing processes.

Crack and Artifact Maps of Block A

These maps (Appendix E) provide a detailed view of exactly what crack patterns look like with depth and how they relate with plotted artifacts. In addition, level notes provide estimates of 1 to 5 mm crack widths in the Paleoindian levels. These maps show that deeper occupations have relatively little evidence of clay cracking, especially in the units excavated in 2007 from which artifacts were size sorted in this paper. While a few artifacts were mapped in or near cracks, the majority of them appeared to be in undisturbed sediment as deep as level 36b. Minimal, narrow cracking at depth corresponds with the conclusion that most materials found at these levels represent intact cultural horizons, with the possibility of very small materials sifting downward through cracks to a limited degree.

Other Analyses

A sample of artifacts were analyzed to measure degrees of heat alteration as well as types of patination, the purpose of which was to try to identify changes in occupation patterns over time. However, neither analysis provided results significant enough to produce meaningful results. Patination characterization was unsuccessful due to the lack of definitive boundaries between different colors of patina, making replicability difficult at best, resulting in meaningless results. A more quantitative and replicable method for recording patination is required to ever fully understand its distribution in the profile.

Thermal alteration was slightly more successful, as only obvious signs of heat alteration were recorded. Results seemed to suggest minor variation in degrees of heat alteration of chert by depth. However, small sample size and the difficulty in identifying heat treatment on smaller artifacts resulted in questionable results. Further analysis with more units may help bolster the sample size of burnt materials, though whether this will produce meaningful results is unknown.

Site Formation and History of Occupations at the Buttermilk Creek Site, Block A

Diagnostic artifacts clearly show intact archaeological materials as deep as level 31 where three Folsom bifaces were found. In addition, two unfluted bifaces with Clovis characteristics found at level 32 suggest the possibility of a Clovis occupation at this level. Size sorting data show that intact cultural materials continue down at least to level 34a and are likely to be in place as deep as levels 35 and 36a. These levels may represent earlier Clovis and even Pre-Clovis aged occupations. Occupations at Block A can be broken down based on size sorting and diagnostic projectile points. Rough age ranges are based solely on diagnostic artifacts. Some levels are not represented (level 31, levels 18-19) due to a lack of available points. For detailed excavation and lab methods, see Appendix A. Hypothesized occupations at Block A can be described as follows:

Early-Late Pleistocene Component

Depth: 90.40-90.20 m below datum (B.D.)

Lv: 33-36a

Estimated Age: Possible Pre-Clovis (pre-11,000 ^{14}C yr. BP.)

Associated Cultural Materials: Diagnostic artifacts are unavailable for these levels. Materials recovered include a number of early-stage bifaces, a roughly lanceolate-shaped biface fragment, small "bladelets" and a bladelet core fragment.

Additional Information: Size sorting analysis indicates that level 34b and possibly level 33b have low relative quantities of larger size categories, indicating that these artifacts are re-deposited small materials rather than an actual intact cultural deposition. This may indicate a depositional episode during a lull in occupation separating this component into later (33a-33b) and earlier (35a-36a) Pre-Clovis components.

Early Paleoindian Component

Depth: 90.475-90.40 m B.D.

Lv: 31a-32b

Estimated Age: Early Paleoindian (10,300-11,100 ^{14}C yr. BP.)

Associated Cultural Materials: three diagnostic Folsom point fragments, two possible Clovis bifaces.

Additional Information: This may be two separate components (Clovis and Folsom) that occurred within relatively close proximity to each other. Presence of a localized spike in percent of size class 1-3 at level 31a (localized almost exclusively in unit 1306N/1357E) may indicate the remains of an intact Folsom early stage lithic reduction feature.

Late Paleoindian Component

Depth: 90.75-90.55 m B.D.

Lv: 26-29

Estimated Age: 10,000-8,500 ^{14}C yr. BP.

Associated Cultural Materials: Diagnostic points include one Dalton/Meserve, seven Golondrina points, two Angostura points, and a number of unfinished, lanceolate bifaces.

Additional Information: A high quantity of diagnostic artifacts and a high ratio of large to small artifacts indicates that these levels consist of secure, in-situ archaeological materials dating to the late Paleoindian period.

Early Archaic Component

Depth: 91.05-90.75 m B.D.

Lv. 20-25

Estimated Age: 8,500-7,000 ^{14}C yr. BP.

Associated Cultural Materials: three Angostura points and two Wells points.

Additional Information: Little size sorting was done on these levels in this analysis due to larger, 5cm levels and the lack of ¼" screening below level 25. Some diagnostic artifacts were mapped in place, showing continued chrono-stratigraphic ordering. This provides a tentative dating of these sediments. Angostura points occur both in this component and the late Paleoindian component, as it is suggested that this point form spans these two time periods (Thoms and Mandel 2007).

"Plow Zone" Component

Depth: 91.50 (surface)-91.15 m B.D.

Lv: 11-17

Estimated Age: 5,500-250 ^{14}C yr. BP.

Associated Cultural Materials: Late-prehistoric arrow points such as Perdiz and Scallorn, Late Archaic dart points Fairland and Edgewood, and some early-mid Archaic points, including Gower, Bell, Early Split-Stem, early triangular points, and late-stage Archaic bifaces.

Additional Information. It is possible that at some point in the history of the area, this property was plowed or otherwise disturbed in the upper sediments, mixing diagnostic artifacts. In addition, almost none of these materials were screened or excavated in 5 cm levels in the field except for 50-by-50 cm^2 test units. Artifacts were mapped if found in place. As a result, some mixing may be the result of displacement during excavation. Deposition rates also seem substantially slower during this period, which could potentially lead to mixing of different occupation surfaces. This component may not necessarily represent a span from early Archaic to late prehistoric, but actually consists of a late Archaic/late prehistoric component with a few older points re-deposited from other parts of the site as a result of recycling, or colluvial/alluvial redeposition.

Implications and Areas of Further Study

This study has implications for both archaeological and pedological fields of study. Work done at the Buttermilk Creek site provides a detailed look at how vertic processes can affect (or fail to affect) macro-sized particles suspended in a vertisol, as well as provide other important data relevant to vertisol formation. Crack maps show how vertic cracks are distributed with depth while calcium carbonate concentrations provide a useful indicator of leaching processes and the depth at which moisture content does not change significantly with seasons, resulting in minimal expansion and contraction and crack formation.

Further, the Buttermilk Creek site Block A provides useful information about the early settlers of the Americas. The identification of intact Paleoindian components at the site is crucial to the further study of the behavior and technology of these early populations. In addition, the possible identification of a component pre-dating Clovis has broad implications in dating the initial colonization of the New World. Future studies will go further to date these components using optically stimulated luminescence dating. In addition, future excavations at Block A with a focus on the recovery of cultural materials from both the Paleoindian and Archaic/late-prehistoric periods could further refine age ranges, rates of deposition, and provide more information on size distribution and vertical movement in vertisols at Block A.

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APPENDIX A

FORMS, EQUIPMENT AND PROCEDURES

All excavation at Buttermilk Creek used a standardized unit and level numbering system based on relation to the base datum first established for the excavation of the nearby Gault site, the coordinates of which were arbitrarily established as being at 1000N, 1000E and 100.0 m el. Table A.1 shows a break down of the levels used at Block A with their corresponding elevations below datum (B.D.).

Table A.1. Buttermilk Creek Level Guide

Level	Top Elev.	Lower Elev.	Level	Top Elev.	Lower Elev.
12a	91.45	91.425	**25a**	90.8	90.775
12b	91.425	91.4	**25b**	90.775	90.75
13a	91.4	91.375	**26a**	90.75	90.725
13b	91.375	91.35	**26b**	90.725	90.7
14a	91.35	91.325	**27a**	90.7	90.675
14b	91.325	91.3	**27b**	90.675	90.65
15a	91.3	91.275	**28a**	90.65	90.625
15b	91.275	91.25	**28b**	90.625	90.6
16a	91.25	91.225	**29a**	90.6	90.575
16b	91.225	91.2	**29b**	90.575	90.55
17a	91.2	91.175	**30a**	90.55	90.525
17b	91.175	91.15	**30b**	90.525	90.5
18a	91.15	91.125	**31a**	90.5	90.475
18b	91.125	91.1	**31b**	90.475	90.45
19a	91.1	91.075	**32a**	90.45	90.425
19b	91.075	91.05	**32b**	90.425	90.4
20a	91.05	91.025	**33a**	90.4	90.375
20b	91.025	91	**33b**	90.375	90.35
21a	91	90.975	**34a**	90.35	90.325
21b	90.975	90.95	**34b**	90.325	90.3
22a	90.95	90.925	**35a**	90.3	90.275
22b	90.925	90.9	**35b**	90.275	90.25
23a	90.9	90.875	**36a**	90.25	90.225
23b	90.875	90.85	**36b**	90.225	90.2
24a	90.85	90.825	**37a**	90.2	90.175
24b	90.825	90.8	**37b**	90.175	90.15

Each unit is numbered based on the northing and easting coordinates of its southwest corner. In addition to level and unit designations, each level excavated in each unit was assigned a specific "AM number" using the same numbering system as Texas A&M excavations at the Lindsey Pit at the Gault site (41BL323) in 2000 and 2001. The following list shows AM numbers used in Texas A&M excavations at Gault and Buttermilk Creek:

Table A.2. AM number guide

AM number	Year	Location
AM 001-999	2000	Lindsey Pit
AM 1000-1999	2001	Lindsey Pit
AM 2000-2999	2006	Buttermilk Creek Blocks A & B
AM 3000-3999	2007	Buttermilk Creek Blocks A & B
AM 4000-5999	2008	Buttermilk Creek Blocks A & B

2006 Excavation of Block A

Excavation in 2006 consisted of units 1306N/1357E, 1306N/1358E, 1307N/1357E, and 1307N/1358E. This block was originally excavated as a 2x2 meter test pit. Beginning at the surface, these units were excavated in 10 cm intervals, each of which encompassed two levels. The first level encompassed levels 11-12 (11a, 11b, 12a, and 12b), while the subsequent levels encompassed levels 13-14, 15-16, etc. The deepest levels excavated were 35-36 which ended at sterile colluvium. A local datum was established using the Total station, which was then used to measure elevations using line levels. Only large flakes or apparently utilized tools were pedestalled and mapped in place at the base of each 10 cm level. In addition, at the base of each 10 cm level, soil disturbances were mapped.

Most excavated sediments were placed in buckets water screened through ¼" (0.625 cm) mesh, collecting all possible debitage and tools from the screen. In all levels 17-18 and deeper, a 25 x 25 cm square was removed from the southwest corner and water screened through 1/8" (0.3125 cm) mesh, collecting all debitage and tools separately from the rest of the unit. In levels 11-16, a 10 x 10 cm square was removed from the southwest corner and washed in 0.3125 cm mesh and collected.

2007 Excavation of Block A

Excavation in 2007 at Block A consisted of a total of 19 units: 1305N/1355E, 1305N/1356E, 1305N/1357E, 1305N/1358E, 1306N/1355E, 1306N/1356E, 1306N/1357E, 1306N/1358E, 1307N/1355E, 1307N/1356E, 1308N/1355E, 1308N/1356E, 1309N/1355E, 1309N/1356E, and 1309N/1357E. In addition, a separate block of four units (aka the Block A Annex) were excavated to the southeast, consisting of units 1288N/1369E, 1289N/1369E, 1290N/1369E, and 1291N/1369E. These units, as well as units 1309N/1355E, 1309N/1356E, and 1309N/1357E were not used in this analysis.

Beginning at the surface, levels 11-18 were removed as a single unit without screening and only mapping and collecting diagnostic artifacts or other possible tools. Levels 19-21 and 22-23 were also each removed as single units using similar collection techniques. Level 24 was then excavated, again without screening or mapping of any artifacts except possible tools. Levels 25 and 26 were each excavated and screened through ¼” (0.625 cm) mesh, taking samples from the southwest 25 by 25 cm of each unit to be screened through 1/8” (0.3125 cm) mesh. All artifacts larger than about 1” in diameter were pedestalled, mapped, and collected at the end of each level.

Beginning with level 27, units were excavated in 2.5 cm levels. To keep the same 5 cm level designations, each level is labeled with an “a” or “b” (ex. Level 27 was split into levels 27a and 27b). Sediments were screened through ¼” (0.625 cm) mesh except for a 25 by 25 cm square in the southwest corner of each unit which was screened through 1/8” (0.3125 cm) mesh. All possible tools were pedestalled, mapped, and collected. In addition, flakes were usually pedestalled, mapped, and collected if larger than 1” in diameter, though in several random cases, this size limit was lowered to ½” diameter or larger. These excavation methods were used until sterile colluvium was reached (from 35b-38a). Units bordering the 2006 excavation had minor amounts of slump ranging from 5-10 cm wide. These units include 1306N/1357E, 1306N/1358E, 1307N/1356E, 1308N/1356E, and 1309N/1357E.

Laser Level

2007 was the first year elevations were measured using a Leica brand Rugby 100 manual-leveling construction laser level. This was set up on a tripod over a temporary datum, the exact location and elevation of which was measured using the total station. The elevation of the datum was then added to the distance from the datum to the laser to get the laser level elevation. Elevations in the block were measured by placing a Leica Rod-eye pro to a measuring rod and subtracting the elevation of the rod at level from the elevation of the laser level. The elevation of the laser level datum was checked on a daily basis using the Total station to ensure that the datum was not moving. The laser level measures elevations within 0.5 mm accuracy, the total station is accurate to about 3mm (depending on distance), making measuring of elevations across a large excavation block easier and more accurate than using traditional line-levels.

2008 Excavation of Block A

Excavation in 2008 at Block A consisted of a total of 22 units: 1300N/1355E, 1300N/1356E, 1300N/1357E, 1300N/1358E, 1301N/1355E, 1301N/1356E, 1301N/1357E, 1301N/1358E, 1302N/1355E, 1302N/1356E, 1302N/1357E, 1302N/1358E, 1303N/1355E, 1303N/1356E, 1303N/1357E, 1303N/1358E, 1303N/1359E, 1304N/1356E, 1304N/1357E, 1304N/1358E, 1304N/1359E, and 1305N/1359E.

Beginning at the surface, levels 11-25 were removed as a single unit with pickaxes without screening and only mapping and collecting diagnostic artifacts. Levels 26, 27, 28, 29, and 30 were each excavated in 5 cm levels and screened through ¼" (0.625 cm) mesh. For these levels, only diagnostic bifaces and occasional tools were mapped when found in situ.

Beginning with level 31, units were excavated in 2.5 cm levels. Sediments were screened through ¼" (0.625 cm) mesh except for a 25 by 25 cm square in the southwest corner of each unit which was screened through 1/8" (0.3125 cm) mesh. All possible tools were pedestalled, mapped, and collected. In addition, flakes were pedestalled, mapped, and collected if larger than 1" in diameter. These excavation methods were used until sterile sediments were reached (from 37a-42). Units bordering the 2007 excavation had significant amounts of slump ranging from 10-30 cm wide. These units include 1304N/1356E, 1304N/1357E, 1304N/1358E, 1304N/1359E, and 1305N/1359E.

The laser level was used again to measure elevations during excavation. In 2008, however, a certain amount of movement of the datum used to calibrate the laser level lead to some issues with elevations. These issues were effectively resolved after the field season was over (see appendix B for details).

50 by 50 units

Two 50 by 50 cm units were excavated from the southwest corners of units 1304N/1356E and 1304N/1358E. 2.5 cm levels were excavated from the surface (12a in 1304N/1356E and 14b in 1304N/1358E) down to sterile colluvium (36b in

1304N/1356E, 39b in 1304N/1358E). Sediments from these levels were water screened through 1/8” (0.3125 cm) mesh and all materials left in the screen were collected. All possible tools and debitage larger than 1” in diameter was pedestalled, mapped, and collected.

Laboratory Methods

All piece plotted artifacts and bulk debitage bags were washed in the lab and entered into an electronic database using Microsoft Access. 1/8” (0.3125 cm) samples were also washed and dried in the lab. In addition, piece-plotted artifacts and larger flakes were labeled with the site number (41BL1239) and AM number. A base coat of Paraloid B-72 was applied, followed by a written label using fountain pens and non-waterproof ink, followed by a top coat of Paraloid B-72. After this, artifacts were sorted by level using stacked Astm E-11 U.S.A. standard test sieves of the following sizes:

Table A.3 Lithic Artifact Size Categories

Size class	**Screen size**
1	1 1/2" (3.75 cm)+
2	1 - 1 1/2" (3.75-2.5 cm)
3	3/4-1" (1.875-2.5 cm)
4	1/2-3/4" (1.25-1.875 cm)
5	3/8-1/2"(0.95-1.25 cm)
6	1/4-3/8" (0.625-0.95 cm)
7	1/8”-1/4" (0.3125-0.625 cm)
8	<1/8" (0.3125 cm) 1/8” samples only

These quantities were recorded on the Buttermilk Creek Site (41BL1239) Block A Debitage Analysis Form shown on the next page. This form was also used to record the presence or absence of patination, heat-treatment, and $CaCO_3$ on flakes and artifacts for units 1305N/1355E, 1305N/1356E, 1305N/1357E, and 1305N/1358E.

Rocks, $CaCO_3$ and flakes from the 50 by 50 units were also separately sorted in the lab using these screens. These categories were weighed, the results of which were recorded on the Block A Size Sorting of 1304/135X (1/8" screen) form. Artifact counts were also recorded on this form.

Buttermilk Creek Site (41BL1239) Block A Debitage Analysis Form

Unit #: ______________________ **Date:** ______________________

AM# **Lv:**

			Patination			CaCO3 presence		Burning presence		Notes
Size	Quantity	Geo	Unpatinated	Speckled	Other	Yes	No	Yes	No	
1										
2										
3										
4										
5										
6										
7										
8										
Total										
Supervisor Initials:			1/8" Sample included? □				Lab tech Init:			

AM# **Lv:**

			Patination			CaCO3 presence		Burning presence		Notes
Size	Quantity	Geo	Unpatinated	Speckled	Other	Yes	No	Yes	No	
1										
2										
3										
4										
5										
6										
7										
8										
Total										
Supervisor Initials:			1/8" Sample included? □				Lab tech Init:			

AM#
: **Lv:**

			Patination			CaCO3 presence		Burning presence		Notes
Size	Quantity	Geo	Unpatinated	Speckled	Other	Yes	No	Yes	No	
1										
2										
3										
4										
5										
6										
7										
8										
Total										
Supervisor Initials:			1/8" Sample included? □				Lab tech Init:			

Buttermilk Creek site (41BL1239) Block A size sorting of 1304/135X (1/8" screen)

AM #: Lv: Init:

Size	Rock weight (g)	CaCO3 weight (g)	Debitage weight (g)	Debitage count
1				
2				
3				
4				
5				
6				
7				
8				

AM #: Lv: Init:

Size	Rock weight (g)	CaCO3 weight (g)	Debitage weight (g)	Debitage count
1				
2				
3				
4				
5				
6				
7				
8				

Notes:

AM #: Lv: Init:

Size	Rock weight (g)	CaCO3 weight (g)	Debitage weight (g)	Debitage count
1				
2				
3				
4				
5				
6				
7				
8				

AM #: Lv: Init:

Size	Rock weight (g)	CaCO3 weight (g)	Debitage weight (g)	Debitage count
1				
2				
3				
4				
5				
6				
7				
8				

Notes:

AM #: Lv: Init:

Size	Rock weight (g)	CaCO3 weight (g)	Debitage weight (g)	Debitage count
1				
2				
3				
4				
5				
6				
7				
8				

AM #: Lv: Init:

Size	Rock weight (g)	CaCO3 weight (g)	Debitage weight (g)	Debitage count
1				
2				
3				
4				
5				
6				
7				
8				

Notes:

Software

Images and statistics for this thesis were made possible through the use of a number of software programs provided by the CSFA, the Anthropology Department at Texas A&M, the Texas A&M student computer labs, and freeware available on the internet. These programs include Adobe Photoshop CS4, Adobe Illustrator CS4, Adobe Acrobat v. 8.0, MYSTAT 12: the student evaluation version provided by SYSTAT, R 2.7.2 and Rcmdr, SPSS 16.0, Goldensoft Surfer 8, and Microsoft Office 2007.

APPENDIX B

EARLY PALEOINDIAN ARTIFACT DRAWINGS

Figure B.1 shows illustrations, created by the author, of the diagnostic Folsom (a-c) and possible Clovis (d-e) artifacts described in Chapter IV. They are shown actual size. All are made from local Edwards chert. In addition, artifacts a,c, and d show signs of $CaCO_3$ formation.

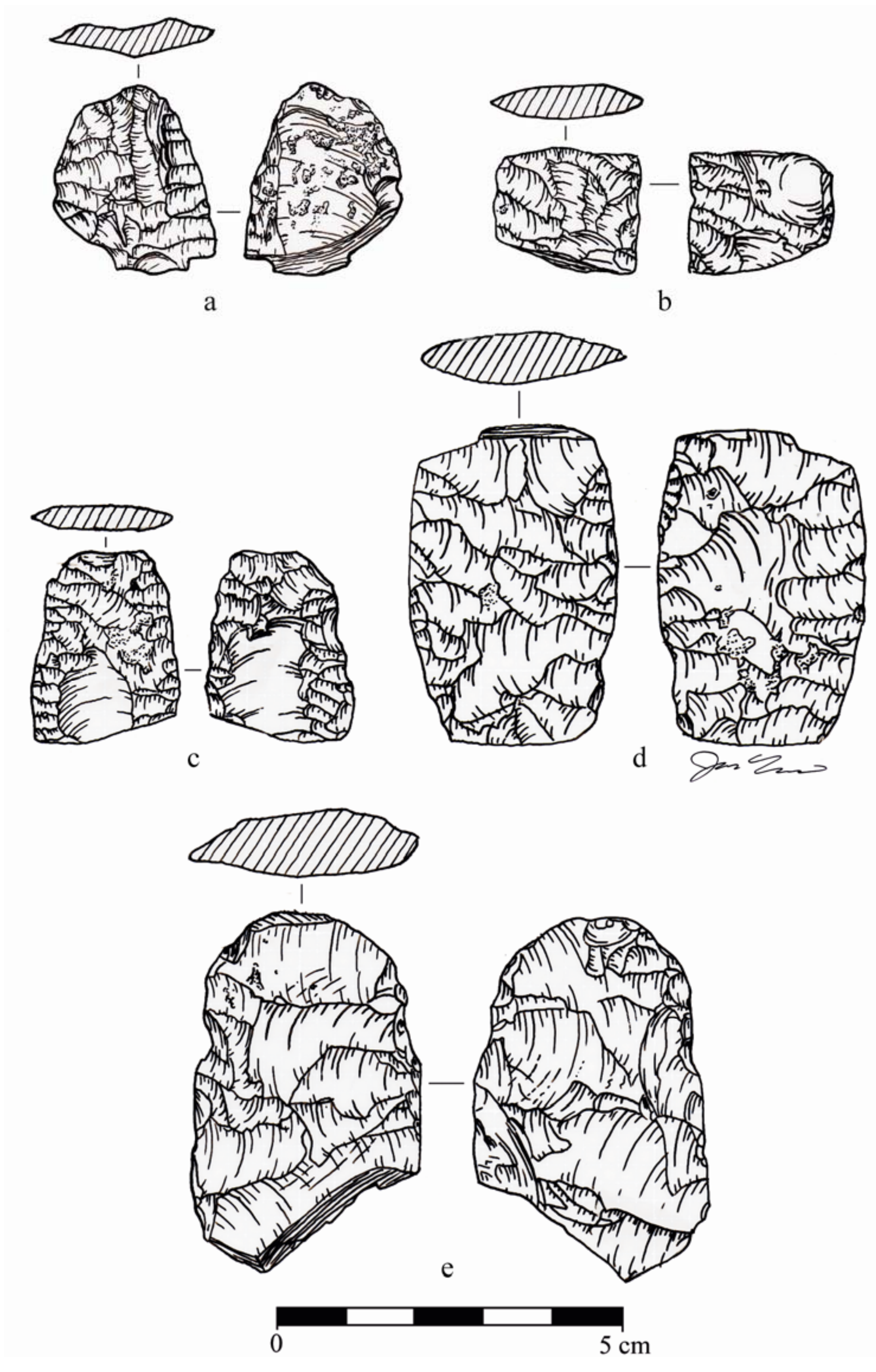


Figure B.1. Diagnostic Folsom point fragments: a) AM4525-1, b) AM4447-1, c) AM3069-6; Possible Clovis bifaces: d) 4581-7, e) 4551-4

APPENDIX C

SIZE-SORTING ANALYSIS: ADDITIONAL STATISTICS

Block A 2007 Size-Sorting: Linear Regression

Figure C.1 shows an expanded view large artifacts (sizes 1-4) versus small artifacts (sizes 6-7). In addition, Figure C.2 shows the same graph using a log(10) scale to account for sample size. Regression analysis was performed on each of these (Tables C.1 and C.2 respectively), each of which shows a very low p-value, indicating a strong trend between small and large artifacts. To further examine this, the residuals from Figure C.1 were plotted by level to see if any upward trend could be proven for small (sizes 6 and 7) artifacts (Figure C.3). Linear regression analysis, however, shows a very high p-value (Table C.3), making it impossible to reject the null hypothesis that there is increase in the relative quantity of size 7 over time.

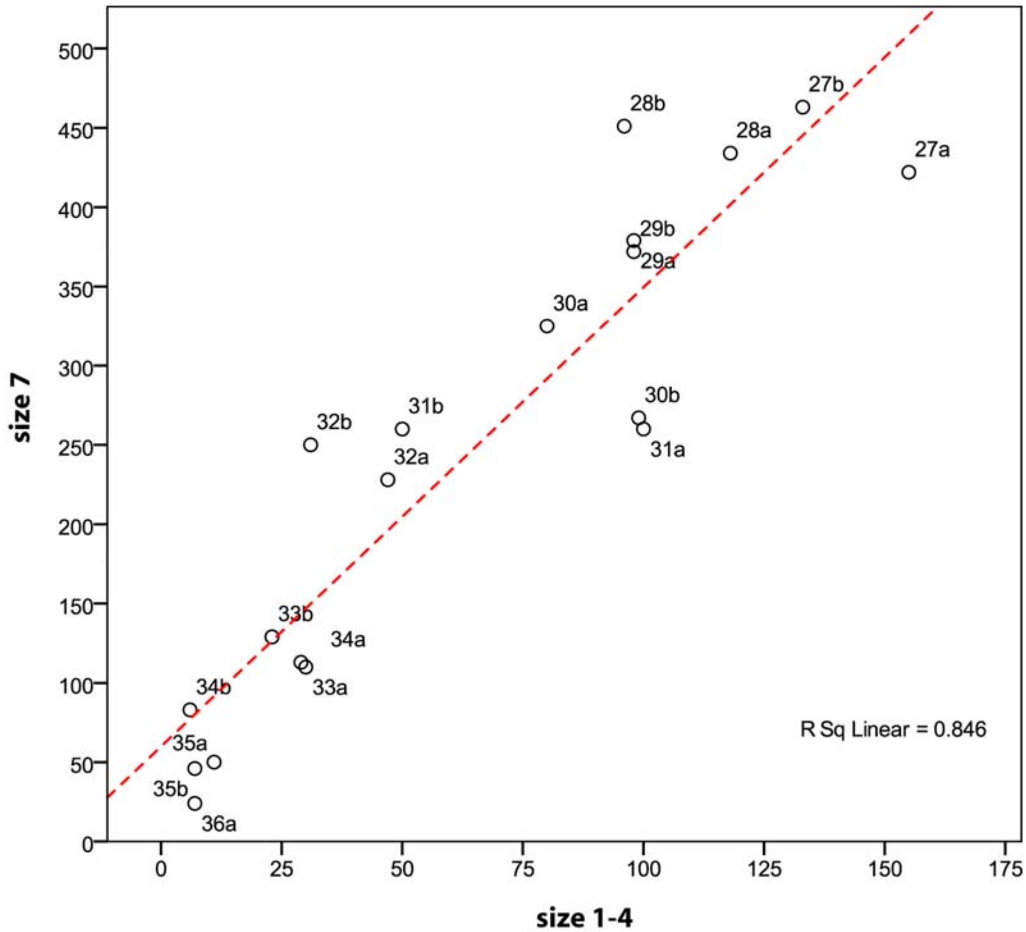


Figure C.1. Comparison of sizes 7 and 1-4

Table C.1. Linear regression analysis of Figure 8

Residuals:

Min	1Q	Median	3Q	Max
-34.396	-8.964	-1.124	5.446	39.380

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-7.60347	8.62613	-0.881	0.39
size7	0.29200	0.03024	9.657	2.58e-08 ***

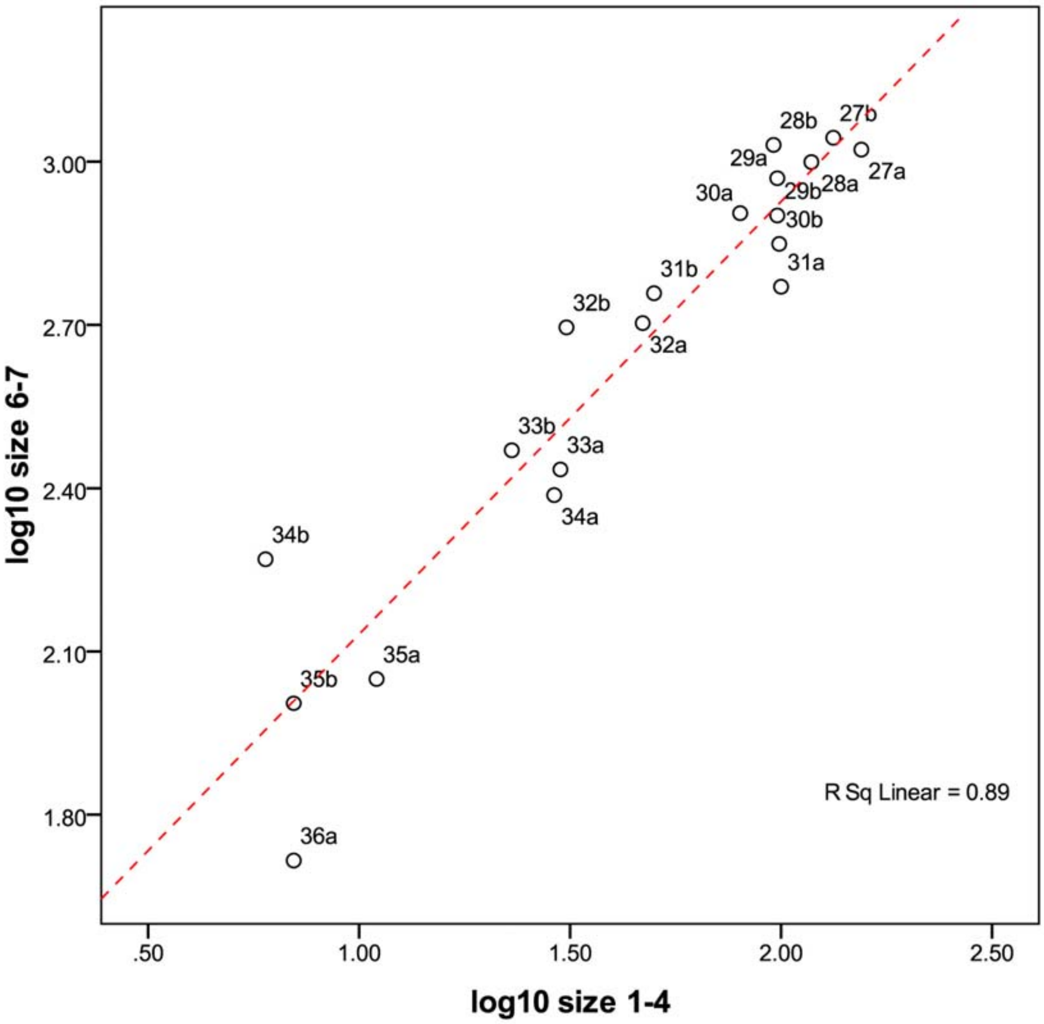


Figure C.2. log-base-10 adjusted comparison of sizes 7 and 1-4

Table C.2. Linear regression analysis of Figure 9

Residuals:

Min	1Q	Median	3Q	Max
-0.29241	-0.07526	0.01547	0.05325	0.31432

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	1.3366	0.1148	11.65	1.58e-09 ***
lsize1234	0.7950	0.0679	11.71	1.47e-09 ***

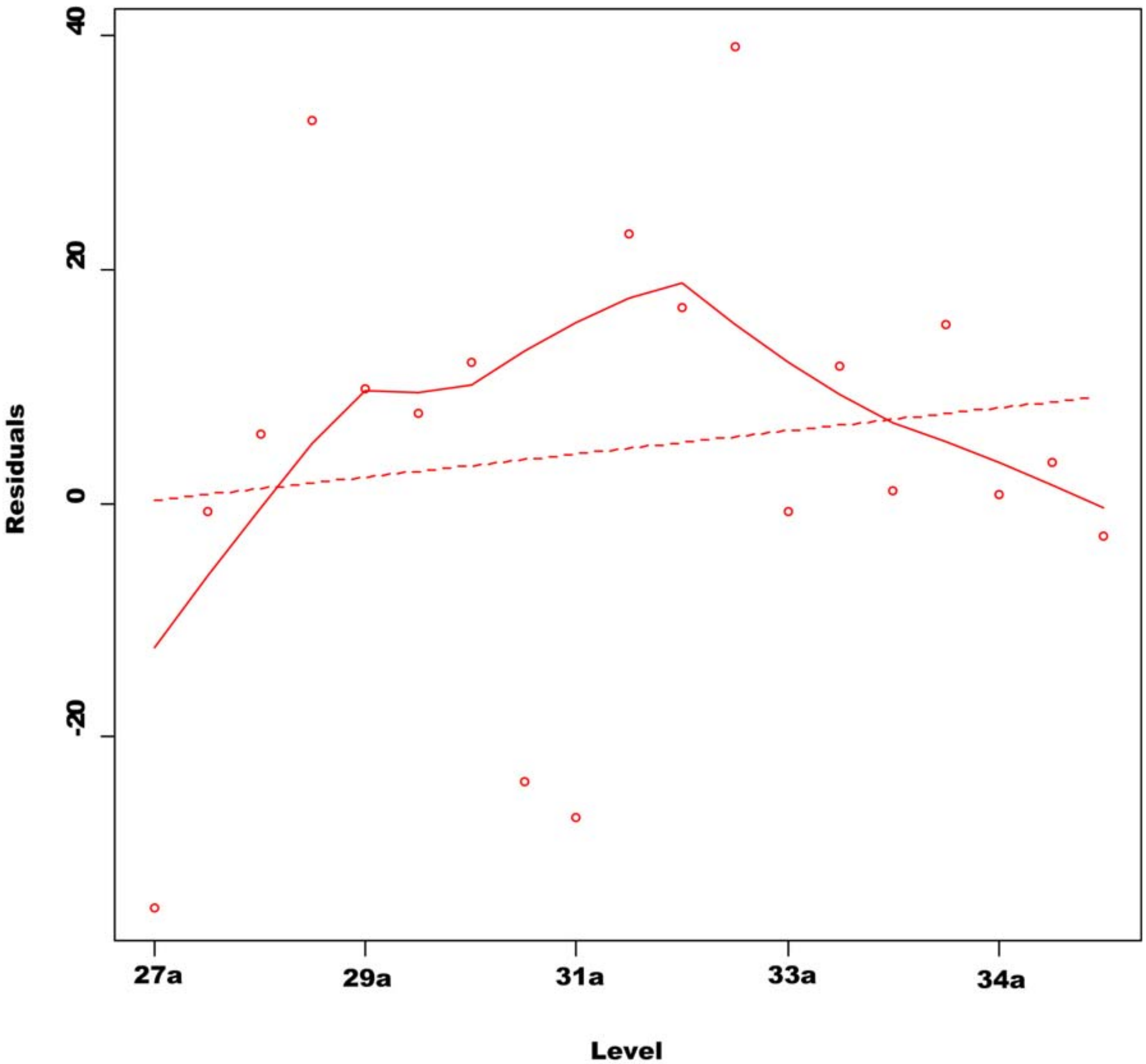


Figure C.3. Plot of residuals from Figure 8 by level

Table C.3. Linear regression analysis of Figure 10

		Residuals:		
Min	1Q	Median	3Q	Max-
33.401	-8.218	-4.606	7.231	34.903
		Coefficients:		
	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-1800.2	2867.7	-0.628	0.539
Level	19.9	31.7	0.628	0.539

APPENDIX D

DATASETS

Block A 2006 Size-Sorting Data

This initial size sorting analysis of the 2006 Block A data included units 1307N/1357E, 1307N/1358E, 1308N/1357E and 1308N. Units were excavated in 10 cm levels and some artifacts may possibly have questionable context due to excavation error. These materials were sorted in my initial study of Block A, but were largely left out of this thesis. In this initial analysis, the following size categories were used: **7**) less than ¼" (not used due to sampling error), **6-5**) 1/4"-1/2", **4**) ½"-3/4", and **1-3**) greater than ¾". Similar screening methods were used as those described in Appendix A.

Table D.1. Size sorting data from Block A 2006

AM #	Unit #	Level	Size Class	Quantity	Weight (g)	total #/lv	total weight/lv
2022	1307/1357	12	7	180	24.9		
2022	1307/1357	12	5-6	290	183.6		
2022	1307/1357	12	4	62	172.2		
2022	1307/1357	12	1-3	26	278.3	558	659
2038	1307/1357	13-14	7	644	87.9		
2038	1307/1357	13-14	5-6	757	402.7		
2038	1307/1357	13-14	4	106	252.8		
2038	1307/1357	13-14	1-3	38	411.8	1545	1155.2
2055	1307/1357	15-16	7	630	82.6		
2055	1307/1357	15-16	5-6	644	339.6		
2055	1307/1357	15-16	4	83	228.3		
2055	1307/1357	15-16	1-3	26	259.3	1383	909.8
2103	1307/1357	17-18	7	290	43.4		
2103	1307/1357	17-18	5-6	403	213.8		
2103	1307/1357	17-18	4	49	94.5		
2103	1307/1357	17-18	1-3	19	224.3	761	576
2112	1307/1357	19-20	7	280	41.5		
2112	1307/1357	19-20	5-6	448	215.2		
2112	1307/1357	19-20	4	38	71.8		
2112	1307/1357	19-20	1-3	18	94.8	784	423.3
2137	1307/1357	21-22	7	234	31.0		
2137	1307/1357	21-22	5-6	522	203.7		
2137	1307/1357	21-22	4	57	136.2		
2137	1307/1357	21-22	1-3	15	91.6	828	462.5
2152	1307/1357	23-24	7	358	50.5		
2152	1307/1357	23-24	5-6	523	302.2		
2152	1307/1357	23-24	4	50	135.9		
2152	1307/1357	23-24	1-3	13	88.3	944	576.9
2166	1307/1357	25-26	7	272	42.0		
2166	1307/1357	25-26	5-6	557	303.0		
2166	1307/1357	25-26	4	64	153.2		
2166	1307/1357	25-26	1-3	5	42.0	898	540.2
2180	1307/1357	27-28	7	132	18.8		
2180	1307/1357	27-28	5-6	278	147.5		
2180	1307/1357	27-28	4	38	75.2		
2180	1307/1357	27-28	1-3	10	55.4	458	296.9
2192	1307/1357	29-30	7	98	15.0		
2192	1307/1357	29-30	5-6	370	145.0		
2192	1307/1357	29-30	4	30	63.0		
2192	1307/1357	29-30	1-3	3	16.0	501	239
2216	1307/1357	31-32	7	100	15.6		
2216	1307/1357	31-32	5-6	170	80.0		
2216	1307/1357	31-32	4	16	30.9		
2216	1307/1357	31-32	1-3	7	31.8	293	158.3
2249	1307/1357	33-34	7	34	34.0		

Table D.1 (cont.)

AM #	Unit #	Level	Size Class	Quantity	Weight (g)	total #/lv	total weight/lv
2249	1307/1357	33-34	5-6	74	35.0		
2249	1307/1357	33-34	4	9	17.0		
2249	1307/1357	33-34	1-3	1	8.0	118	94
2273	1307/1357	35-36	7	20	3.0		
2273	1307/1357	35-36	5-6	32	13.0		
2273	1307/1357	35-36	4	4	12.0		
2273	1307/1357	35-36	1-3	2	14.0	58	42
2288	1307/1357	37-38	7	2	0.2		
2288	1307/1357	37-38	5-6	3	1.0		
2288	1307/1357	37-38	4	0	0.0		
2288	1307/1357	37-38	1-3	0	0.0	5	1.2
2070	1307/1358	12-14	7	866	101.0		
2070	1307/1358	12-14	5-6	952	526.0		
2070	1307/1358	12-14	4	139	384.0		
2070	1307/1358	12-14	1-3	45	504.6	2002	1515.6
2086	1307/1358	15-16	7	458	52.0		
2086	1307/1358	15-16	5-6	679	320.0		
2086	1307/1358	15-16	4	138	353.0		
2086	1307/1358	15-16	1-3	50	936.0	1325	1661
2106	1307/1358	17-18	7	298	45.0		
2106	1307/1358	17-18	5-6	438	219.0		
2106	1307/1358	17-18	4	60	161.0		
2106	1307/1358	17-18	1-3	18	112.0	814	537
2125	1307/1358	19-20	7	218	33.8		
2125	1307/1358	19-20	5-6	371	188.6		
2125	1307/1358	19-20	4	49	131.1		
2125	1307/1358	19-20	1-3	13	111.8	651	465.3
2143	1307/1358	21-22	7	245	34.8		
2143	1307/1358	21-22	5-6	397	214.4		
2143	1307/1358	21-22	4	44	117.8		
2143	1307/1358	21-22	1-3	15	123.4	701	490.4
2158	1307/1358	23-24	7	243	33.3		
2158	1307/1358	23-24	5-6	384	201.3		
2158	1307/1358	23-24	4	45	99.6		
2158	1307/1358	23-24	1-3	10	78.1	682	412.3
2176	1307/1358	25-26	7	219	33.9		
2176	1307/1358	25-26	5-6	434	221.0		
2176	1307/1358	25-26	4	65	156.9		
2176	1307/1358	25-26	1-3	17	117.6	735	529.4
2195	1307/1358	27-28	7	193	30.7		
2195	1307/1358	27-28	5-6	392	239.6		
2195	1307/1358	27-28	4	58	142.3		
2195	1307/1358	27-28	1-3	16	90.3	659	502.9
2202	1307/1358	29-30	7	131	21.7		
2202	1307/1358	29-30	5-6	317	162.5		

Table D.1 (cont.)

AM #	Unit #	Level	Size Class	Quantity	Weight (g)	total #/lv	total weight/lv
2202	1307/1358	29-30	4	56	124.3		
2202	1307/1358	29-30	1-3	6	41.8	510	350.3
2228	1307/1358	31-32	7	118	17.3		
2228	1307/1358	31-32	5-6	255	136.7		
2228	1307/1358	31-32	4	34	83.4		
2228	1307/1358	31-32	1-3	10	67.8	417	305.2
2256	1307/1358	33-34	7	48	9.7		
2256	1307/1358	33-34	5-6	118	54.2		
2256	1307/1358	33-34	4	10	21.5		
2256	1307/1358	33-34	1-3	1	4.6	177	90
2298	1307/1358	35-36	7	39	6.5		
2298	1307/1358	35-36	5-6	45	19.3		
2298	1307/1358	35-36	4	1	1.7		
2298	1307/1358	35-36	1-3	0	0.0	85	27.5
2079	1308/1358	15-16	7	355	49.3		
2079	1308/1358	15-16	5-6	430	211.2		
2079	1308/1358	15-16	4	56	146.6		
2079	1308/1358	15-16	1-3	19	249.2	860	656.3
2097	1308/1358	17-18	7	364	52.7		
2097	1308/1358	17-18	5-6	382	187.0		
2097	1308/1358	17-18	4	38	108.8		
2097	1308/1358	17-18	1-3	9	86.0	793	434.5
2114	1308/1358	19-20	7	412	59.3		
2114	1308/1358	19-20	5-6	428	277.5		
2114	1308/1358	19-20	4	43	118.6		
2114	1308/1358	19-20	1-3	8	47.6	891	503
2136	1308/1358	21-22	7	315	48.2		
2136	1308/1358	21-22	5-6	457	251.1		
2136	1308/1358	21-22	4	49	129.2		
2136	1308/1358	21-22	1-3	11	73.8	832	502.3
2150	1308/1358	23-24	7	275	39.1		
2150	1308/1358	23-24	5-6	416	212.7		
2150	1308/1358	23-24	4	50	125.4		
2150	1308/1358	23-24	1-3	9	73.5	750	450.7
2164	1308/1358	25-26	7	212	33.5		
2164	1308/1358	25-26	5-6	449	237.3		
2164	1308/1358	25-26	4	56	120.2		
2164	1308/1358	25-26	1-3	8	49.6	725	440.6
2182	1308/1358	27-28	7	94	15.2		
2182	1308/1358	27-28	5-6	210	115.2		
2182	1308/1358	27-28	4	25	71.7		
2182	1308/1358	27-28	1-3	3	55.3	332	257.4
2217	1308/1358	29-30	7	164	26.6		
2217	1308/1358	29-30	5-6	413	209.9		
2217	1308/1358	29-30	4	65	151.0		

Table D.1 (cont.)

AM #	Unit #	Level	Size Class	Quantity	Weight (g)	total #/lv	total weight/lv
2217	1308/1358	29-30	1-3	13	92.2	655	479.7
2246	1308/1358	31-32	7	131	20.3		
2246	1308/1358	31-32	5-6	392	214.3		
2246	1308/1358	31-32	4	61	135.9		
2246	1308/1358	31-32	1-3	20	57.3	604	427.8
2268	1308/1358	33-34	7	81	11.4		
2268	1308/1358	33-34	5-6	104	56.8		
2268	1308/1358	33-34	4	13	29.4		
2268	1308/1358	33-34	1-3	2	8.5	200	106.1
2321	1308/1358	35-36	7	30	4.4		
2321	1308/1358	35-36	5-6	63	24.9		
2321	1308/1358	35-36	4	1	2.7		
2321	1308/1358	35-36	1-3	0	0.0	94	32
2332	1308/1358	37-38	7	5	0.7		
2332	1308/1358	37-38	5-6	15	6.9		
2332	1308/1358	37-38	4	2	5.0		
2332	1308/1358	37-38	1-3	0	0.0	22	12.6
2069	1308/1357	15-16	7	494	67.0		
2069	1308/1357	15-16	5-6	757	414.1		
2069	1308/1357	15-16	4	112	305.0		
2069	1308/1357	15-16	1-3	55	521.0	1418	1307.1
2087	1308/1357	17-18	7	370	53.5		
2087	1308/1357	17-18	5-6	519	297.4		
2087	1308/1357	17-18	4	44	133.3		
2087	1308/1357	17-18	1-3	17	171.4	950	655.6
2126	1308/1357	19-20	7	245	39.2		
2126	1308/1357	19-20	5-6	329	180.4		
2126	1308/1357	19-20	4	39	107.2		
2126	1308/1357	19-20	1-3	5	38.5	618	365.3
2144	1308/1357	21-22	7	316	48.9		
2144	1308/1357	21-22	5-6	482	242.0		
2144	1308/1357	21-22	4	46	115.6		
2144	1308/1357	21-22	1-3	11	99.5	855	506
2160	1308/1357	23-24	7	253	37.1		
2160	1308/1357	23-24	5-6	503	246.2		
2160	1308/1357	23-24	4	55	116.8		
2160	1308/1357	23-24	1-3	21	159.2	832	559.3
2175	1308/1357	25-26	7	227	33.6		
2175	1308/1357	25-26	5-6	464	234.4		
2175	1308/1357	25-26	4	60	132.3		
2175	1308/1357	25-26	1-3	15	124.5	766	524.8
2187	1308/1357	27-28	7	73	27.7		
2187	1308/1357	27-28	5-6	407	232.4		
2187	1308/1357	27-28	4	50	128.8		
2187	1308/1357	27-28	1-3	7	38.9	537	427.8

Table D.1 (cont.)

AM #	Unit #	Level	Size Class	Quantity	Weight (g)	total #/lv	total weight/lv
2205	1308/1357	29-30	7	192	27.8		
2205	1308/1357	29-30	5-6	382	192.4		
2205	1308/1357	29-30	4	54	99.9		
2205	1308/1357	29-30	1-3	10	63.8	638	383.9
2230	1308/1357	31-32	7	152	21.2		
2230	1308/1357	31-32	5-6	289	140.8		
2230	1308/1357	31-32	4	36	68.3		
2230	1308/1357	31-32	1-3	13	75.2	490	305.5
2237	1308/1357	33-34	7	147	19.6		
2237	1308/1357	33-34	5-6	155	81.8		
2237	1308/1357	33-34	4	20	44.4		
2237	1308/1357	33-34	1-3	0	0.0	322	145.8
2257	1308/1357	35-36	7	35	5.1		
2257	1308/1357	35-36	5-6	71	34.1		
2257	1308/1357	35-36	4	6	15.2		
2257	1308/1357	35-36	1-3	0	0.0	112	54.4

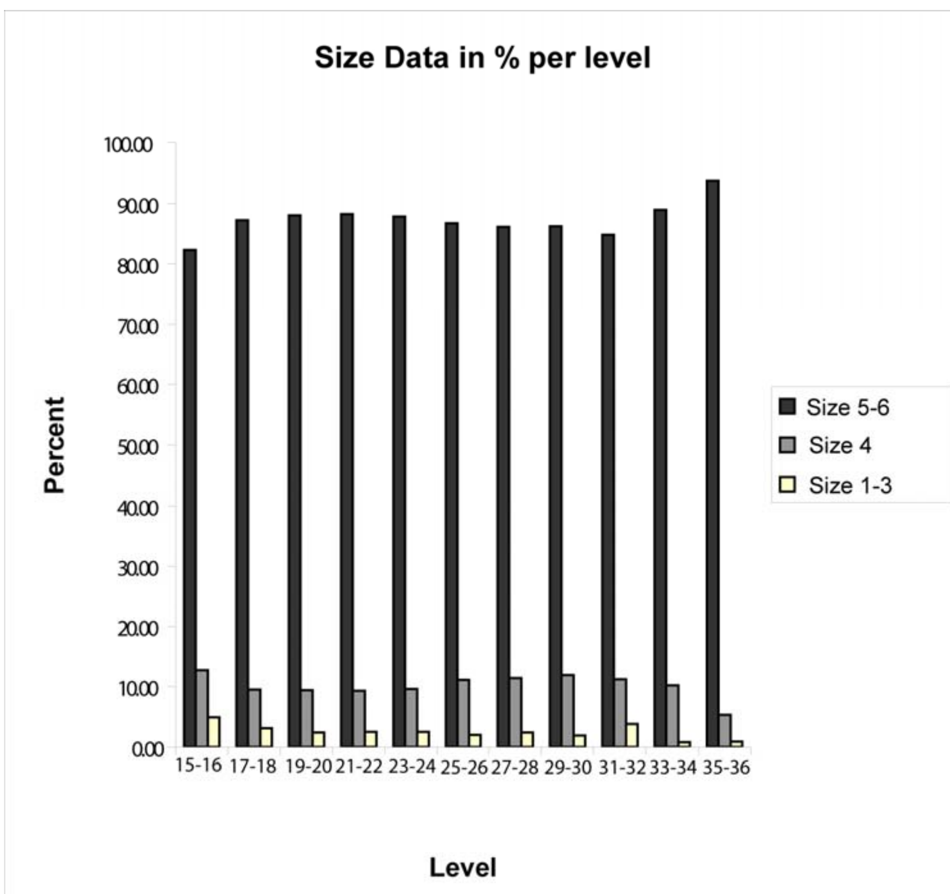


Figure D.1. Size sorting information from the Block A 2006 test pits without size class 7

Block A 2007 Dataset

The first group of Tables shows all size sorting, patination, CaCO3, and burning data for units 1305N/1355E, 1305N/1356E, 1305N/1357E, and 1305N/1358. The second group of Tables shows all size sorting data for the remaining units: 1306N/1355E, 1306N/1356E, 1306N/1357E, 1306N/1358E, 1307N/1355E, 1307N/1356E, 1308N/1355E, and 1308N/1356E. The third group shows 50-by-50 data from unit 1304N/1356E (all weights are in grams).

Table D.2. Patination, heat-treatment, and CaCO3 presense data

Unit	AM	lv	size	#	unpat	speckle	otherpat	CaCO3Y	CaCO3N	BurnY	BurnN	total
1305/1355	2788	27a	1	0	0	0	0	0	0	0	0	
1305/1355	2788	27a	2	0	0	0	0	0	0	0	0	
1305/1355	2788	27a	3	2	0	0	2	1	1	0	2	
1305/1355	2788	27a	4	11	1	6	4	1	10	1	10	
1305/1355	2788	27a	5	16	1	9	6	1	15	1	15	
1305/1355	2788	27a	6	43	9	17	17	3	40	3	40	
1305/1355	2788	27a	7	33	5	8	20	1	32	4	29	
1305/1355	2788	27a	8	33								105
1305/1355	2855	27b	1	0	0	0	0	0	0	0	0	
1305/1355	2855	27b	2	2	0	2	0	2	0	0	2	
1305/1355	2855	27b	3	1	0	1	0	1	0	0	1	
1305/1355	2855	27b	4	12	1	6	5	6	6	1	11	
1305/1355	2855	27b	5	9	0	3	6	4	5	2	7	
1305/1355	2855	27b	6	46	4	28	14	12	34	0	46	
1305/1355	2855	27b	7	34	4	13	17	5	29	1	33	
1305/1355	2855	27b	8	26								104
1305/1355	2883	28a	1	0	0	0	0	0	0	0	0	
1305/1355	2883	28a	2	0	0	0	0	0	0	0	0	
1305/1355	2883	28a	3	0	0	0	0	0	0	0	0	
1305/1355	2883	28a	4	6	0	3	3	4	2	1	5	
1305/1355	2883	28a	5	13	1	6	6	9	4	0	13	
1305/1355	2883	28a	6	48	5	23	20	19	29	6	42	
1305/1355	2883	28a	7	26	2	10	14	6	20	0	26	
1305/1355	2883	28a	8	20								93
1305/1355	2897	28b	1	0	0	0	0	0	0	0	0	
1305/1355	2897	28b	2	1	0	1	0	1	0	0	1	
1305/1355	2897	28b	3	2	0	1	1	2	0	0	2	
1305/1355	2897	28b	4	9	0	6	3	8	1	0	9	
1305/1355	2897	28b	5	20	0	10	10	10	10	5	15	
1305/1355	2897	28b	6	49	3	26	20	28	21	5	43	
1305/1355	2897	28b	7	41	0	24	17	16	25	0	41	
1305/1355	2897	28b	8	38								122
1305/1355	2931	29a	1	0	0	0	0	0	0	0	0	
1305/1355	2931	29a	2	1	0	1	0	1	0	0	1	
1305/1355	2931	29a	3	0	0	0	0	0	0	0	0	
1305/1355	2931	29a	4	7	0	4	3	6	1	0	7	
1305/1355	2931	29a	5	15	0	8	7	10	5	0	15	
1305/1355	2931	29a	6	42	0	23	19	24	18	1	41	
1305/1355	2931	29a	7	21	0	13	8	8	13	4	17	
1305/1355	2931	29a	8	33								86
1305/1355	2943	29b	1	0	0	0	0	0	0	0	0	
1305/1355	2943	29b	2	0	0	1	0	0	0	0	0	
1305/1355	2943	29b	3	0	0	0	0	0	0	0	0	
1305/1355	2943	29b	4	5	0	2	3	3	2	0	5	
1305/1355	2943	29b	5	9	2	5	2	5	4	2	7	
1305/1355	2943	29b	6	24	4	5	15	9	15	2	22	
1305/1355	2943	29b	7	17	1	4	12	3	14	0	17	
1305/1355	2943	29b	8	28								55
1305/1355	2969	30a	1	0	0	0	0	0	0	0	0	
1305/1355	2969	30a	2	0	0	0	0	0	0	0	0	
1305/1355	2969	30a	3	0	0	0	0	0	0	0	0	
1305/1355	2969	30a	4	7	0	4	3	6	1	3	4	
1305/1355	2969	30a	5	15	0	10	5	15	0	2	13	

Table D.2 (cont.)

Unit	AM	lv	size	#	unpat	speckle	otherpat	CaCO3Y	CaCO3N	BurnY	BurnN	total
1305/1355	2969	30a	6	39	2	24	13	30	9	1	38	
1305/1355	2969	30a	7	20	0	14	6	9	11	2	18	
1305/1355	2969	30a	8	24								
1305/1355	2987	30b	1	0	0	0	0	0	0	0	0	59
1305/1355	2987	30b	2	0	0	0	0	0	0	0	0	
1305/1355	2987	30b	3	1	0	1	0	1	0	0	1	
1305/1355	2987	30b	4	5	0	4	1	5	0	0	5	
1305/1355	2987	30b	5	17	0	10	7	16	1	0	17	
1305/1355	2987	30b	6	49	5	25	19	32	17	4	45	
1305/1355	2987	30b	7	24	3	7	14	9	15	2	22	
1305/1355	2987	30b	8	28								
1305/1355	3019	31a	1	0	0	0	0	0	0	0	0	96
1305/1355	3019	31a	2	1	0	1	0	1	0	0	1	
1305/1355	3019	31a	3	0	0	0	0	0	0	0	0	
1305/1355	3019	31a	4	4	0	3	1	4	0	0	4	
1305/1355	3019	31a	5	7	0	6	1	5	2	1	6	
1305/1355	3019	31a	6	28	3	15	10	22	6	2	26	
1305/1355	3019	31a	7	16	2	7	7	6	10	1	15	
1305/1355	3019	31a	8	23								
1305/1355	3051	31b	1	0	0	0	0	0	0	0	0	56
1305/1355	3051	31b	2	1	0	0	0	0	0	0	0	
1305/1355	3051	31b	3	0	0	0	0	0	0	0	0	
1305/1355	3051	31b	4	4	0	2	0	1	1	0	2	
1305/1355	3051	31b	5	10	0	6	2	7	1	3	5	
1305/1355	3051	31b	6	22	5	7	7	10	9	1	18	
1305/1355	3051	31b	7	9	10	8	9	10	17	3	24	
1305/1355	3051	31b	8	28								
1305/1355	3108	32a	1	0	0	0	0	0	0	0	0	46
1305/1355	3108	32a	2	0	0	0	0	0	0	0	0	
1305/1355	3108	32a	3	0	0	0	0	0	0	0	0	
1305/1355	3108	32a	4	2	0	2	0	1	1	0	2	
1305/1355	3108	32a	5	8	0	6	2	7	1	3	5	
1305/1355	3108	32a	6	19	5	7	7	10	9	1	18	
1305/1355	3108	32a	7	27	10	8	9	10	17	3	24	
1305/1355	3108	32a	8	17								
1305/1355	3164	32b	1	0	0	0	0	0	0	0	0	56
1305/1355	3164	32b	2	0	0	0	0	0	0	0	0	
1305/1355	3164	32b	3	0	0	0	0	0	0	0	0	
1305/1355	3164	32b	4	4	1	3	0	3	1	1	3	
1305/1355	3164	32b	5	4	0	2	2	4	0	0	4	
1305/1355	3164	32b	6	18	0	12	6	9	9	2	16	
1305/1355	3164	32b	7	13	0	8	5	4	9	0	13	
1305/1355	3164	32b	8	17								
1305/1355	3191	33a	1	0	0	0	0	0	0	0	0	39
1305/1355	3191	33a	2	0	0	0	0	0	0	0	0	
1305/1355	3191	33a	3	0	0	0	0	0	0	0	0	
1305/1355	3191	33a	4	0	0	0	0	0	0	0	0	
1305/1355	3191	33a	5	3	0	2	1	1	2	0	3	
1305/1355	3191	33a	6	10	0	4	6	9	1	1	9	
1305/1355	3191	33a	7	10	0	3	7	4	6	1	9	
1305/1355	3191	33a	8									
1305/1355	3253	33b	1	0	0	0	0	0	0	0	0	23
1305/1355	3253	33b	2	0	0	0	0	0	0	0	0	

Table D.2 (cont.)

Unit	AM	lv	size	#	unpat	speckle	otherpat	CaCO3Y	CaCO3N	BurnY	BurnN	total
1305/1355	3253	33b	3	0	0	0	0	0	0	0	0	
1305/1355	3253	33b	4	0	0	0	0	0	0	0	0	
1305/1355	3253	33b	5	0	0	0	0	0	0	0	0	
1305/1355	3253	33b	6	15	0	3	12	8	7	3	12	
1305/1355	3253	33b	7	5	2	1	2	4	1	0	5	
1305/1355	3253	33b	8	9								
1305/1355	3275	34a	1	0	0	0	0	0	0	0	0	20
1305/1355	3275	34a	2	0	0	0	0	0	0	0	0	
1305/1355	3275	34a	3	0	0	0	0	0	0	0	0	
1305/1355	3275	34a	4	1	0	1	0	1	0	0	1	
1305/1355	3275	34a	5	3	0	1	2	2	1	1	2	
1305/1355	3275	34a	6	6	0	2	4	4	2	1	5	
1305/1355	3275	34a	7	4	0	1	3	2	2	1	3	
1305/1355	3275	34a	8	10								
1305/1355	3342	34b	1	0	0	0	0	0	0	0	0	14
1305/1355	3342	34b	2	0	0	0	0	0	0	0	0	
1305/1355	3342	34b	3	0	0	0	0	0	0	0	0	
1305/1355	3342	34b	4	0	0	0	0	0	0	0	0	
1305/1355	3342	34b	5	0	0	0	0	0	0	0	0	
1305/1355	3342	34b	6	6	0	4	2	3	3	2	4	
1305/1355	3342	34b	7	7	0	4	3	4	3	1	6	
1305/1355	3342	34b	8	15								
1305/1355	3378	35a	1	0	0	0	0	0	0	0	0	13
1305/1355	3378	35a	2	0	0	0	0	0	0	0	0	
1305/1355	3378	35a	3	0	0	0	0	0	0	0	0	
1305/1355	3378	35a	4	0	0	0	0	0	0	0	0	
1305/1355	3378	35a	5	0	0	0	0	0	0	0	0	
1305/1355	3378	35a	6	2	1	1	0	2	0	0	2	
1305/1355	3378	35a	7	0	0	0	0	0	0	0	0	
1305/1355	3378	35a	8	4								
1305/1355	3398	35b	1	0	0	0	0	0	0	0	0	2
1305/1355	3398	35b	2	0	0	0	0	0	0	0	0	
1305/1355	3398	35b	3	0	0	0	0	0	0	0	0	
1305/1355	3398	35b	4	0	0	0	0	0	0	0	0	
1305/1355	3398	35b	5	1	0	1	0	1	0	0	1	
1305/1355	3398	35b	6	0	0	0	0	0	0	0	0	
1305/1355	3398	35b	7	0	0	0	0	0	0	0	0	
1305/1355	3398	35b	8	2								
1305/1355	3440	36a	1	0	0	0	0	0	0	0	0	1
1305/1355	3440	36a	2	0	0	0	0	0	0	0	0	
1305/1355	3440	36a	3	0	0	0	0	0	0	0	0	
1305/1355	3440	36a	4	0	0	0	0	0	0	0	0	
1305/1355	3440	36a	5	0	0	0	0	0	0	0	0	
1305/1355	3440	36a	6	1	0	1	0	0	1	0	1	
1305/1355	3440	36a	7	0	0	0	0	0	0	0	0	
1305/1355	3440	36a	8	2						0	0	
1305/1355	3499	36b	1	0	0	0	0	0	0	0	0	1
1305/1355	3499	36b	2	0	0	0	0	0	0	0	0	
1305/1355	3499	36b	3	0	0	0	0	0	0	0	0	
1305/1355	3499	36b	4	0	0	0	0	0	0	0	0	
1305/1355	3499	36b	5	0	0	0	0	0	0	0	0	
1305/1355	3499	36b	6	0	0	0	0	0	0	0	0	
1305/1355	3499	36b	7	2	0	0	2	1	1	1	1	

Table D.2 (cont.)

Unit	AM	lv	size	#	unpat	speckle	otherpat	CaCO3Y	CaCO3N	BurnY	BurnN	total
1305/1355	3499	36b	8	5								
1305/1356	2805	27a	1	0	0	0	0	0	0	0	0	2
1305/1356	2805	27a	2	0	0	0	0	0	0	0	0	
1305/1356	2805	27a	3	5	0	5	0	5	0	0	5	
1305/1356	2805	27a	4	14	0	8	6	10	4	1	13	
1305/1356	2805	27a	5	26	0	15	11	12	14	0	26	
1305/1356	2805	27a	6	67	1	45	21	19	48	3	64	
1305/1356	2805	27a	7	31	1	20	10	3	28	1	30	
1305/1356	2805	27a	8	19								
1305/1356	2843	27b	1	0	0							143
1305/1356	2843	27b	2	0	0							
1305/1356	2843	27b	3	2	0	2	1	2	1	0	3	
1305/1356	2843	27b	4	10	0	9	1	10	0	1	9	
1305/1356	2843	27b	5	33	0	18	15	20	13	0	33	
1305/1356	2843	27b	6	57	2	41	30	22	51	5	68	
1305/1356	2843	27b	7	59	2	25	39	2	64	1	65	
1305/1356	2843	27b	8	28								
1305/1356	2867	28a	1	0	0	0	0	0	0	0	0	161
1305/1356	2867	28a	2	1	0	1	0	1	0	0	1	
1305/1356	2867	28a	3	0	0	0	0	0	0	0	0	
1305/1356	2867	28a	4	9	0	7	2	8	1	1	8	
1305/1356	2867	28a	5	22	1	11	10	10	12	1	21	
1305/1356	2867	28a	6	55	1	25	29	14	41	5	50	
1305/1356	2867	28a	7	31	0	14	17	5	26	2	29	
1305/1356	2867	28a	8	22								
1305/1356	2913	28b	1	0	0	0	0	0	0	0	0	118
1305/1356	2913	28b	2	0	0	0	0	0	0	0	0	
1305/1356	2913	28b	3	0	0	0	0	0	0	0	0	
1305/1356	2913	28b	4	7	0	5	2	7	0	1	6	
1305/1356	2913	28b	5	13	1	10	2	6	7	1	12	
1305/1356	2913	28b	6	61	6	35	20	13	48	3	58	
1305/1356	2913	28b	7	39	2	21	16	3	36	2	37	
1305/1356	2913	28b	8	15								
1305/1356	2923	29a	1	0	0	0	0	0	0	0	0	120
1305/1356	2923	29a	2	0	0	0	0	0	0	0	0	
1305/1356	2923	29a	3	2	0	2	0	1	1	0	2	
1305/1356	2923	29a	4	12	0	7	5	7	5	2	10	
1305/1356	2923	29a	5	14	1	7	6	8	6	1	13	
1305/1356	2923	29a	6	61	2	26	33	23	38	3	58	
1305/1356	2923	29a	7	41	0	28	13	6	35	3	38	
1305/1356	2923	29a	8	21								
1305/1356	2961	29b	1	0	0	0	0	0	0	0	0	130
1305/1356	2961	29b	2	1	0	1	0	0	1	0	1	
1305/1356	2961	29b	3	1	0	1	0	1	0	1	0	
1305/1356	2961	29b	4	5	0	5	0	4	1	0	5	
1305/1356	2961	29b	5	17	0	15	2	10	8	3	15	
1305/1356	2961	29b	6	51	0	27	24	25	26	5	46	
1305/1356	2961	29b	7	43	0	27	16	16	27	2	41	
1305/1356	2961	29b	8	23								
1305/1356	3000	30a	1	0	0	0	0	0	0	0	0	118
1305/1356	3000	30a	2	0	0	0	0	0	0	0	0	
1305/1356	3000	30a	3	0	0	0	0	0	0	0	0	
1305/1356	3000	30a	4	5	0	5	0	3	2	1	4	

Table D.2 (cont.)

Unit	AM	lv	size	#	unpat	speckle	otherpat	CaCO3Y	CaCO3N	BurnY	BurnN	total
1305/1356	3000	30a	5	19	0	15	4	13	6	0	19	
1305/1356	3000	30a	6	59	0	42	17	27	32	7	52	
1305/1356	3000	30a	7	37	0	23	14	22	15	4	33	
1305/1356	3000	30a	8	12								
1305/1356	3012	30b	1	0	0	0	0	0	0	0	0	120
1305/1356	3012	30b	2	0	0	0	0	0	0	0	0	
1305/1356	3012	30b	3	3	0	3	0	3	0	0	3	
1305/1356	3012	30b	4	12	0	6	6	9	3	1	11	
1305/1356	3012	30b	5	17	0	13	4	13	4	1	16	
1305/1356	3012	30b	6	51	0	28	23	36	15	4	47	
1305/1356	3012	30b	7	32	1	17	14	14	18	0	32	
1305/1356	3012	30b	8	14								
1305/1356	3039	31a	1	0	0	0	0	0	0	0	0	115
1305/1356	3039	31a	2	0	0	0	0	0	0	0	0	
1305/1356	3039	31a	3	0	0	0	0	0	0	0	0	
1305/1356	3039	31a	4	5	0	4	1	5	0	0	5	
1305/1356	3039	31a	5	11	0	6	0	10	1	1	10	
1305/1356	3039	31a	6	33	0	21	17	19	14	2	31	
1305/1356	3039	31a	7	38	1	17	20	16	22	0	38	
1305/1356	3039	31a	8	16								
1305/1356	3069	31b	1	0	0	0	0	0	0	0	0	87
1305/1356	3069	31b	2	0	0	0	0	0	0	0	0	
1305/1356	3069	31b	3	1	0	1	0	1	0	0	1	
1305/1356	3069	31b	4	5	0	4	1	5	0	0	5	
1305/1356	3069	31b	5	11	0	9	2	9	2	1	10	
1305/1356	3069	31b	6	35	1	19	15	23	12	2	33	
1305/1356	3069	31b	7	27	1	20	6	15	12	1	26	
1305/1356	3069	31b	8	16								
1305/1356	3138	32a	1	0	0	0	0	0	0	0	0	79
1305/1356	3138	32a	2	0	0	0	0	0	0	0	0	
1305/1356	3138	32a	3	1	0	1	0	1	0	0	1	
1305/1356	3138	32a	4	5	0	4	1	5	0	1	4	
1305/1356	3138	32a	5	15	0	11	4	13	2	1	14	
1305/1356	3138	32a	6	32	0	23	9	21	11	1	31	
1305/1356	3138	32a	7	27	0	20	7	16	11	2	25	
1305/1356	3138	32a	8	21								
1305/1356	3205	32b	1	0	0	0	0	0	0	0	0	80
1305/1356	3205	32b	2	0	0	0	0	0	0	0	0	
1305/1356	3205	32b	3	0	0	0	0	0	0	0	0	
1305/1356	3205	32b	4	6	0	4	2	6	0	1	5	
1305/1356	3205	32b	5	13	0	6	7	12	1	3	10	
1305/1356	3205	32b	6	32	1	21	10	25	7	2	30	
1305/1356	3205	32b	7	35	0	23	12	24	11	3	32	
1305/1356	3205	32b	8	6								
1305/1356	3239	33a	1	0	0	0	0	0	0	0	0	86
1305/1356	3239	33a	2	0	0	0	0	0	0	0	0	
1305/1356	3239	33a	3	1	0	3	0	3	0	1	2	
1305/1356	3239	33a	4	7	0	5	2	6	1	1	6	
1305/1356	3239	33a	5	11	0	6	5	11	0	0	11	
1305/1356	3239	33a	6	22	1	13	8	21	6	1	26	
1305/1356	3239	33a	7	11	0	6	5	11	0	1	10	
1305/1356	3239	33a	8	13								
1305/1356	3306	33b	1	0	0	0	0	0	0	0	0	52

Table D.2 (cont.)

Unit	AM	lv	size	#	unpat	speckle	otherpat	CaCO3Y	CaCO3N	BurnY	BurnN	total
1305/1356	3306	33b	2	0	0	0	0	0	0	0	0	
1305/1356	3306	33b	3	0	0	0	0	0	0	0	0	
1305/1356	3306	33b	4	3	0	3	0	3	0	1	2	
1305/1356	3306	33b	5	7	0	5	2	6	1	1	6	
1305/1356	3306	33b	6	26	0	18	8	22	4	2	24	
1305/1356	3306	33b	7	25	0	18	7	13	12	1	24	
1305/1356	3306	33b	8	11								
1305/1356	3322	34a	1	0	0	0	0	0	0	0	0	61
1305/1356	3322	34a	2	0	0	0	0	0	0	0	0	
1305/1356	3322	34a	3	2	0	2	0	2	0	0	2	
1305/1356	3322	34a	4	4	0	2	2	4	0	1	3	
1305/1356	3322	34a	5	4	0	3	1	4	0	0	4	
1305/1356	3322	34a	6	25	1	19	5	20	5	4	21	
1305/1356	3322	34a	7	15	0	10	5	10	5	2	13	
1305/1356	3322	34a	8	7								
1305/1356	3358	34b	1	0								50
1305/1356	3358	34b	2	0	0	0	0	0	0	0	0	
1305/1356	3358	34b	3	0	0	0	0	0	0	0	0	
1305/1356	3358	34b	4	0	0	0	0	0	0	0	0	
1305/1356	3358	34b	5	4	0	2	2	3	1	0	4	
1305/1356	3358	34b	6	13	0	9	4	12	1	0	13	
1305/1356	3358	34b	7	9	0	4	5	6	3	0	9	
1305/1356	3358	34b	8	10								
1305/1356	3406	35a	1	0	0	0	0	0	0	0	0	26
1305/1356	3406	35a	2	0	0	0	0	0	0	0	0	
1305/1356	3406	35a	3	0	0	0	0	0	0	0	0	
1305/1356	3406	35a	4	1	0	1	0	1	0	0	1	
1305/1356	3406	35a	5	3	0	2	1	3	0	0	3	
1305/1356	3406	35a	6	2	0	2	0	2	0	0	2	
1305/1356	3406	35a	7	6	0	5	1	5	1	1	5	
1305/1356	3406	35a	8	7								
1305/1356	3424	35b	1	0	0	0	0	0	0	0	0	12
1305/1356	3424	35b	2	0	0	0	0	0	0	0	0	
1305/1356	3424	35b	3	0	0	0	0	0	0	0	0	
1305/1356	3424	35b	4	0	0	0	0	0	0	0	0	
1305/1356	3424	35b	5	0	0	0	0	0	0	0	0	
1305/1356	3424	35b	6	3	0	3	0	1	2	0	3	
1305/1356	3424	35b	7	2	0	0	2	1	1	0	2	
1305/1356	3424	35b	8	5								
1305/1356	3461	36a	1	0	0	0	0	0	0	0	0	5
1305/1356	3461	36a	2	0	0	0	0	0	0	0	0	
1305/1356	3461	36a	3	0	0	0	0	0	0	0	0	
1305/1356	3461	36a	4	0	0	0	0	0	0	0	0	
1305/1356	3461	36a	5	0	0	0	0	0	0	0	0	
1305/1356	3461	36a	6	2	0	1	1	1	1	0	2	
1305/1356	3461	36a	7	2	0	0	2	0	2	0	2	
1305/1356	3461	36a	8	5								
1305/1356	3475	36b	1	0	0	0	0	0	0	0	0	4
1305/1356	3475	36b	2	0	0	0	0	0	0	0	0	
1305/1356	3475	36b	3	0	0	0	0	0	0	0	0	
1305/1356	3475	36b	4	0	0	0	0	0	0	0	0	
1305/1356	3475	36b	5	0	0	0	0	0	0	0	0	
1305/1356	3475	36b	6	0	0	0	0	0	0	0	0	

Table D.2 (cont.)

Unit	AM	lv	size	#	unpat	speckle	otherpat	CaCO3Y	CaCO3N	BurnY	BurnN	total
1305/1356	3475	36b	7	1	0	0	1	0	1	0	1	
1305/1356	3475	36b	8	1								
1305/1356	3487	37a	1	0	0	0	0	0	0	0	0	1
1305/1356	3487	37a	2	0	0	0	0	0	0	0	0	
1305/1356	3487	37a	3	0	0	0	0	0	0	0	0	
1305/1356	3487	37a	4	0	0	0	0	0	0	0	0	
1305/1356	3487	37a	5	0	0	0	0	0	0	0	0	
1305/1356	3487	37a	6	0	0	0	0	0	0	0	0	
1305/1356	3487	37a	7	0	0	0	0	0	0	0	0	
1305/1356	3487	37a	8	0								
1305/1356	3508	37b	1	0	0	0	0	0	0	0	0	0
1305/1356	3508	37b	2	0	0	0	0	0	0	0	0	
1305/1356	3508	37b	3	0	0	0	0	0	0	0	0	
1305/1356	3508	37b	4	1	0	0	1	1	0	0	1	
1305/1356	3508	37b	5	0	0	0	0	0	0	0	0	
1305/1356	3508	37b	6	0	0	0	0	0	0	0	0	
1305/1356	3508	37b	7	0	0	0	0	0	0	0	0	
1305/1356	3508	37b	8	0								
1305/1357	2825	27a	1	0	0	0	0	0	0	0	0	1
1305/1357	2825	27a	2	0	0	0	0	0	0	0	0	
1305/1357	2825	27a	3	2	0	1	1	1	1	0	2	
1305/1357	2825	27a	4	11	1	6	3	1	9	4	6	
1305/1357	2825	27a	5	28	3	18	6	7	21	3	25	
1305/1357	2825	27a	6	55	10	16	27	6	49	8	47	
1305/1357	2825	27a	7	51	11	12	29	3	49	4	48	
1305/1357	2825	27a	8									
1305/1357	2857	27b	1	0	0	0	0	0	0	0	0	147
1305/1357	2857	27b	2	0	0	0	0	0	0	0	0	
1305/1357	2857	27b	3	1	0	1	0	1	0	0	1	
1305/1357	2857	27b	4	6	0	4	2	5	1	2	4	
1305/1357	2857	27b	5	12	0	5	7	6	6	1	11	
1305/1357	2857	27b	6	55	2	29	24	21	34	2	53	
1305/1357	2857	27b	7	44	0	14	30	9	35	3	41	
1305/1357	2857	27b	8	26								
1305/1357	2891	28a	1	0	0	0	0	0	0	0	0	118
1305/1357	2891	28a	2	0	0	0	0	0	0	0	0	
1305/1357	2891	28a	3	1	0	0	1	1	0	0	1	
1305/1357	2891	28a	4	9	0	8	1	8	1	0	9	
1305/1357	2891	28a	5	20	0	9	11	9	11	2	18	
1305/1357	2891	28a	6	56	0	26	30	25	31	5	51	
1305/1357	2891	28a	7	46	1	25	20	13	33	5	41	
1305/1357	2891	28a	8	37								
1305/1357	2941	28b	1	0	0	0	0	0	0	0	0	132
1305/1357	2941	28b	2	0	0	0	0	0	0	0	0	
1305/1357	2941	28b	3	2	0	1	1	2	0	0	0	
1305/1357	2941	28b	4	6	0	5	1	3	3	0	6	
1305/1357	2941	28b	5	31	0	16	15	14	17	3	28	
1305/1357	2941	28b	6	60	0	22	38	22	38	5	55	
1305/1357	2941	28b	7	57	0	25	32	9	48	3	54	
1305/1357	2941	28b	8	21								
1305/1357	2979	29a	1	0	0	0	0	0	0	0	0	156
1305/1357	2979	29a	2	0	0	0	0	0	0	0	0	
1305/1357	2979	29a	3	1	0	0	1	1	0	0	1	

Table D.2 (cont.)

Unit	AM	lv	size	#	unpat	speckle	otherpat	CaCO3Y	CaCO3N	BurnY	BurnN	total
1305/1357	2979	29a	4	9	0	4	5	5	4	1	8	
1305/1357	2979	29a	5	21	0	11	10	14	8	0	21	
1305/1357	2979	29a	6	32	0	24	8	12	20	1	31	
1305/1357	2979	29a	7	21	0	16	5	3	18	0	21	
1305/1357	2979	29a	8	21								
1305/1357	2985	29b	1	0	0	0	0	0	0	0	0	84
1305/1357	2985	29b	2	0	0	0	0	0	0	0	0	
1305/1357	2985	29b	3	0	0	0	0	0	0	0	0	
1305/1357	2985	29b	4	9	0	5	4	8	1	1	8	
1305/1357	2985	29b	5	21	0	17	4	17	4	1	20	
1305/1357	2985	29b	6	46	0	26	20	27	19	1	45	
1305/1357	2985	29b	7	29	0	21	8	13	16	3	26	
1305/1357	2985	29b	8	26								
1305/1357	3037	30a	1	0	0	0	0	0	0	0	0	105
1305/1357	3037	30a	2	0	0	0	0	0	0	0	0	
1305/1357	3037	30a	3	0	0	0	0	0	0	0	0	
1305/1357	3037	30a	4	6	0	4	2	5	1	0	6	
1305/1357	3037	30a	5	14	0	9	5	13	1	1	13	
1305/1357	3037	30a	6	44	0	27	17	18	26	2	42	
1305/1357	3037	30a	7	20	0	11	9	8	12	1	19	
1305/1357	3037	30a	8	27								
1305/1357	3063	30b	1	0	0	0	0	0	0	0	0	84
1305/1357	3063	30b	2	0	0	0	0	0	0	0	0	
1305/1357	3063	30b	3	1	0	1	0	1	0	0	1	
1305/1357	3063	30b	4	4	0	4	0	3	1	0	4	
1305/1357	3063	30b	5	13	0	9	4	11	2	0	13	
1305/1357	3063	30b	6	36	0	20	16	23	13	4	32	
1305/1357	3063	30b	7	27	0	16	11	11	16	0	27	
1305/1357	3063	30b	8	15								
1305/1357	3095	31a	1	0	0	0	0	0	0	0	0	81
1305/1357	3095	31a	2	0	0	0	0	0	0	0	0	
1305/1357	3095	31a	3	1	0	1	0	1	0	0	1	
1305/1357	3095	31a	4	4	0	0	4	4	0	0	4	
1305/1357	3095	31a	5	12	0	7	5	9	3	0	12	
1305/1357	3095	31a	6	32	1	12	19	26	6	1	31	
1305/1357	3095	31a	7	12	1	9	2	8	4	2	10	
1305/1357	3095	31a	8	18								
1305/1357	3106	31b	1	0	0	0	0	0	0	0	0	61
1305/1357	3106	31b	2	0	0	0	0	0	0	0	0	
1305/1357	3106	31b	3	1	0	1	0	1	0	1	0	
1305/1357	3106	31b	4	1	0	1	0	1	0	0	1	
1305/1357	3106	31b	5	15	0	7	8	10	5	1	14	
1305/1357	3106	31b	6	31	0	20	11	24	7	2	29	
1305/1357	3106	31b	7	18	0	10	8	11	7	1	17	
1305/1357	3106	31b	8	18								
1305/1357	3160	32a	1	0	0	0	0	0	0	0	0	66
1305/1357	3160	32a	2	0	0	0	0	0	0	0	0	
1305/1357	3160	32a	3	2	0	1	1	2	0	0	2	
1305/1357	3160	32a	4	2	0	1	1	2	0	0	2	
1305/1357	3160	32a	5	9	0	8	1	7	2	1	8	
1305/1357	3160	32a	6	27	0	17	10	20	7	0	27	
1305/1357	3160	32a	7	20	0	12	8	14	6	2	18	
1305/1357	3160	32a	8	13								

Table D.2 (cont.)

Unit	AM	lv	size	#	unpat	speckle	otherpat	CaCO3Y	CaCO3N	BurnY	BurnN	total
1305/1357	3176	32b	1	0	0	0	0	0	0	0	0	60
1305/1357	3176	32b	2	0	0	0	0	0	0	0	0	
1305/1357	3176	32b	3	2	0	1	1	2	0	0	2	
1305/1357	3176	32b	4	1	0	1	0	1	0	0	1	
1305/1357	3176	32b	5	5	0	3	2	2	3	0	5	
1305/1357	3176	32b	6	23	1	7	15	18	5	1	22	
1305/1357	3176	32b	7	25	0	15	10	17	8	1	26	
1305/1357	3176	32b	8	6								
1305/1357	3189	33a	1	0	0	0	0	0	0	0	0	56
1305/1357	3189	33a	2	0	0	0	0	0	0	0	0	
1305/1357	3189	33a	3	0	0	1	0	1	0	0	1	
1305/1357	3189	33a	4	1	0	0	1	1	0	0	1	
1305/1357	3189	33a	5	2	1	1	0	2	0	1	1	
1305/1357	3189	33a	6	11	0	9	2	9	2	1	10	
1305/1357	3189	33a	7	8	0	5	3	4	4	0	8	
1305/1357	3189	33a	8	10								
1305/1357	3256	33b	1	0	0	0	0	0	0	0	0	22
1305/1357	3256	33b	2	0	0	0	0	0	0	0	0	
1305/1357	3256	33b	3	1	0	1	0	1	0	0	1	
1305/1357	3256	33b	4	2	0	2	0	2	0	0	2	
1305/1357	3256	33b	5	3	0	1	2	1	2	1	2	
1305/1357	3256	33b	6	18	0	12	6	12	6	2	16	
1305/1357	3256	33b	7	9	1	3	5	1	8	0	9	
1305/1357	3256	33b	8									
1305/1357	3283	34a	1	0	0	0	0	0	0	0	0	33
1305/1357	3283	34a	2	0	0	0	0	0	0	0	0	
1305/1357	3283	34a	3	1	0	0	1	1	0	0	1	
1305/1357	3283	34a	4	0	0	0	0	0	0	0	0	
1305/1357	3283	34a	5	3	0	3	0	3	0	0	3	
1305/1357	3283	34a	6	13	0	8	5	11	2	0	13	
1305/1357	3283	34a	7	6	0	2	4	2	4	0	6	
1305/1357	3283	34a	8	5								
1305/1357	3340	34b	1	0	0	0	0	0	0	0	0	23
1305/1357	3340	34b	2	0	0	0	0	0	0	0	0	
1305/1357	3340	34b	3	1	0	0	1	1	0	0	1	
1305/1357	3340	34b	4	0	0	0	0	0	0	0	0	
1305/1357	3340	34b	5	4	0	2	2	4	0	1	3	
1305/1357	3340	34b	6	8	0	4	4	5	3	1	7	
1305/1357	3340	34b	7	13	0	8	5	8	5	0	13	
1305/1357	3340	34b	8	6								
1305/1357	3426	35a	1	0	0	0	0	0	0	0	0	26
1305/1357	3426	35a	2	0	0	0	0	0	0	0	0	
1305/1357	3426	35a	3	0	0	0	0	0	0	0	0	
1305/1357	3426	35a	4	1	0	0	1	1	0	0	1	
1305/1357	3426	35a	5	1	0	1	0	1	0	0	1	
1305/1357	3426	35a	6	5	0	3	2	3	2	1	4	
1305/1357	3426	35a	7	1	0	0	1	1	0	0	1	
1305/1357	3426	35a	8	6								
1305/1357	3438	35b	1	0	0	0	0	0	0	0	0	8
1305/1357	3438	35b	2	0	0	0	0	0	0	0	0	
1305/1357	3438	35b	3	0	0	0	0	0	0	0	0	
1305/1357	3438	35b	4	1	0	1	0	1	0	0	1	
1305/1357	3438	35b	5	2	0	1	1	2	0	1	1	

Table D.2 (cont.)

Unit	AM	lv	size	#	unpat	speckle	otherpat	CaCO3Y	CaCO3N	BurnY	BurnN	total
1305/1357	3438	35b	6	2	0	1	1	1	1	0	2	
1305/1357	3438	35b	7	7	0	5	2	4	3	0	7	
1305/1357	3438	35b	8	4								
1305/1357	2458	36a	1	0	0	0	0	0	0	0	0	12
1305/1357	2458	36a	2	0	0	0	0	0	0	0	0	
1305/1357	2458	36a	3	1	0	1	0	1	0	0	1	
1305/1357	2458	36a	4	0	0	0	0	0	0	0	0	
1305/1357	2458	36a	5	1	0	0	1	1	0	0	1	
1305/1357	2458	36a	6	0	0	0	0	0	0	0	0	
1305/1357	2458	36a	7	4	0	1	3	3	1	0	4	
1305/1357	2458	36a	8	3								
1305/1357	3465	36b	1	0	0	0	0	0	0	0	0	6
1305/1357	3465	36b	2	0	0	0	0	0	0	0	0	
1305/1357	3465	36b	3	0	0	0	0	0	0	0	0	
1305/1357	3465	36b	4	1	0	1	0	1	0	0	1	
1305/1357	3465	36b	5	0	0	0	0	0	0	0	0	
1305/1357	3465	36b	6	0	0	0	0	0	0	0	0	
1305/1357	3465	36b	7	2	0	0	2	2	0	0	2	
1305/1357	3465	36b	8	6								
1305/1357	3501	37a	1	0	0	0	0	0	0	0	0	3
1305/1357	3501	37a	2	0	0	0	0	0	0	0	0	
1305/1357	3501	37a	3	0	0	0	0	0	0	0	0	
1305/1357	3501	37a	4	1	0	0	1	0	1	0	1	
1305/1357	3501	37a	5	0	0	0	0	0	0	0	0	
1305/1357	3501	37a	6	2	0	1	1	0	2	0	2	
1305/1357	3501	37a	7	1	1	0	0	0	1	0	1	
1305/1357	3501	37a	8	0								
1305/1357	3527	37b	1	0	0	0	0	0	0	0	0	4
1305/1357	3527	37b	2	0	0	0	0	0	0	0	0	
1305/1357	3527	37b	3	1	0	0	1	1	0	0	1	
1305/1357	3527	37b	4	0	0	0	0	0	0	0	0	
1305/1357	3527	37b	5	0	0	0	0	0	0	0	0	
1305/1357	3527	37b	6	0	0	0	0	0	0	0	0	
1305/1357	3527	37b	7	0	0	0	0	0	0	0	0	
1305/1357	3527	37b	8	2								
1305/1358	2794	27a	1	1	0	1	0	1	0	0	1	1
1305/1358	2794	27a	2	0	0	0	0	0	0	0	0	
1305/1358	2794	27a	3	3	0	3	0	2	1	0	3	
1305/1358	2794	27a	4	12	0	7	5	10	2	1	11	
1305/1358	2794	27a	5	20	0	15	5	10	10	4	16	
1305/1358	2794	27a	6	49	1	26	22	20	29	3	46	
1305/1358	2794	27a	7	21	0	13	8	4	18	0	21	
1305/1358	2794	27a	8	12								
1305/1358	2841	27b	1	0	0	0	0	0	0	0	0	106
1305/1358	2841	27b	2	0	0	0	0	0	0	0	0	
1305/1358	2841	27b	3	3	0	3	0	3	0	0	3	
1305/1358	2841	27b	4	12	0	11	1	8	4	1	11	
1305/1358	2841	27b	5	29	0	17	11	14	15	2	27	
1305/1358	2841	27b	6	50	1	24	22	15	35	1	49	
1305/1358	2841	27b	7	39	0	12	27	4	47	2	49	
1305/1358	2841	27b	8	17								
1305/1358	2879	28a	1	0	0	0	0	0	0	0	0	133
1305/1358	2879	28a	2	0	0	0	0	0	0	0	0	

Table D.2 (cont.)

Unit	AM	lv	size	#	unpat	speckle	otherpat	CaCO3Y	CaCO3N	BurnY	BurnN	total
1305/1358	2879	28a	3	4	0	1	3	4	0	0	4	
1305/1358	2879	28a	4	9	0	6	3	7	2	2	7	
1305/1358	2879	28a	5	25	0	18	7	14	11	3	22	
1305/1358	2879	28a	6	62	1	36	25	21	41	3	59	
1305/1358	2879	28a	7	31	0	16	15	6	25	3	28	
1305/1358	2879	28a	8	15								
1305/1358	2921	28b	1	0	0	0	0	0	0	0	0	131
1305/1358	2921	28b	2	0	0	0	0	0	0	0	0	
1305/1358	2921	28b	3	1	0	1	0	1	0	0	1	
1305/1358	2921	28b	4	11	0	9	2	8	3	0	11	
1305/1358	2921	28b	5	28	0	23	5	12	16	2	26	
1305/1358	2921	28b	6	41	0	24	17	15	26	2	39	
1305/1358	2921	28b	7	31	0	17	14	6	25	0	31	
1305/1358	2921	28b	8	18								
1305/1358	2959	29a	1	0	0	0	0	0	0	0	0	112
1305/1358	2959	29a	2	0	0	0	0	0	0	0	0	
1305/1358	2959	29a	3	3	0	2	1	3	0	0	3	
1305/1358	2959	29a	4	11	0	9	2	8	3	1	10	
1305/1358	2959	29a	5	23	0	15	8	12	11	0	23	
1305/1358	2959	29a	6	51	0	27	24	18	33	3	48	
1305/1358	2959	29a	7	33	1	12	20	6	27	1	32	
1305/1358	2959	29a	8	25								
1305/1358	3004	29b	1	1	0	1	0	1	0	0	1	121
1305/1358	3004	29b	2	0	0	0	0	0	0	0	0	
1305/1358	3004	29b	3	4	0	4	0	4	0	0	4	
1305/1358	3004	29b	4	18	0	12	6	14	4	3	15	
1305/1358	3004	29b	5	19	0	14	5	9	10	2	17	
1305/1358	3004	29b	6	42	0	22	20	9	33	2	40	
1305/1358	3004	29b	7	31	0	17	14	9	22	2	29	
1305/1358	3004	29b	8	18								
1305/1358	3017	30a	1	0	0	0	0	0	0	0	0	115
1305/1358	3017	30a	2	0	0	0	0	0	0	0	0	
1305/1358	3017	30a	3	0	0	0	0	0	0	0	0	
1305/1358	3017	30a	4	15	0	7	8	10	5	1	14	
1305/1358	3017	30a	5	17	0	13	4	15	2	1	15	
1305/1358	3017	30a	6	48	1	28	19	22	26	3	45	
1305/1358	3017	30a	7	28	0	13	15	8	20	2	76	
1305/1358	3017	30a	8	16								
1305/1358	3049	30b	1	0	0	0	0	0	0	0	0	108
1305/1358	3049	30b	2	0	0	0	0	0	0	0	0	
1305/1358	3049	30b	3	0	0	0	0	0	0	0	0	
1305/1358	3049	30b	4	7	0	5	2	7	0	1	6	
1305/1358	3049	30b	5	21	0	13	8	16	5	1	20	
1305/1358	3049	30b	6	49	0	27	22	24	25	1	48	
1305/1358	3049	30b	7	28	0	16	12	13	15	5	29	
1305/1358	3049	30b	8	12								
1305/1358	3065	31a	1	0	0	0	0	0	0	0	0	105
1305/1358	3065	31a	2	1	0	1	1	1	0	0	1	
1305/1358	3065	31a	3	0	0	0	0	0	0	0	0	
1305/1358	3065	31a	4	8	0	5	3	7	1	1	7	
1305/1358	3065	31a	5	16	0	11	5	13	3	1	15	
1305/1358	3065	31a	6	32	0	14	18	21	11	2	30	
1305/1358	3065	31a	7	32	0	18	14	15	16	2	30	

Table D.2 (cont.)

Unit	AM	lv	size	#	unpat	speckle	otherpat	CaCO3Y	CaCO3N	BurnY	BurnN	total
1305/1358	3065	31a	8	9								
1305/1358	3120	31b	1	0	0	0	0	0	0	0	0	89
1305/1358	3120	31b	2	0	0	0	0	0	0	0	0	
1305/1358	3120	31b	3	0	0	0	0	0	0	0	0	
1305/1358	3120	31b	4	7	0	6	1	5	2	0	7	
1305/1358	3120	31b	5	12	0	10	2	9	3	0	15	
1305/1358	3120	31b	6	35	0	19	16	20	15	0	35	
1305/1358	3120	31b	7	35	0	19	16	20	15	0	35	
1305/1358	3120	31b	8	8								
1305/1358	3134	32a	1	0	0	0	0	0	0	0	0	89
1305/1358	3134	32a	2	0	0	0	0	0	0	0	0	
1305/1358	3134	32a	3	0	0	0	0	0	0	0	0	
1305/1358	3134	32a	4	8	0	3	5	8	0	1	7	
1305/1358	3134	32a	5	13	0	7	6	7	6	0	13	
1305/1358	3134	32a	6	42	0	29	13	25	17	2	40	
1305/1358	3134	32a	7	22	0	12	10	3	19	1	21	
1305/1358	3134	32a	8	13								
1305/1358	3201	32b	1	0	0	0	0	0	0	0	0	85
1305/1358	3201	32b	2	0	0	0	0	0	0	0	0	
1305/1358	3201	32b	3	1	0	1	0	1	0	0	1	
1305/1358	3201	32b	4	1	0	1	0	1	0	0	1	
1305/1358	3201	32b	5	11	0	5	6	9	2	0	11	
1305/1358	3201	32b	6	27	0	14	13	17	10	0	27	
1305/1358	3201	32b	7	24	0	11	13	13	11	2	22	
1305/1358	3201	32b	8	7								
1305/1358	3223	33a	1	0	0	0	0	0	0	0	0	64
1305/1358	3223	33a	2	0	0	0	0	0	0	0	0	
1305/1358	3223	33a	3	1	0	1	0	1	0	0	1	
1305/1358	3223	33a	4	8	0	6	2	7	1	1	7	
1305/1358	3223	33a	5	11	0	8	3	8	3	0	11	
1305/1358	3223	33a	6	28	0	9	19	12	16	3	25	
1305/1358	3223	33a	7	15	0	12	3	9	6	0	15	
1305/1358	3223	33a	8	9								
1305/1358	3241	33b	1	0	0	0	0	0	0	0	0	63
1305/1358	3241	33b	2	0	0	0	0	0	0	0	0	
1305/1358	3241	33b	3	1	0	0	1	1	0	1	0	
1305/1358	3241	33b	4	3	2	0	1	2	1	0	3	
1305/1358	3241	33b	5	6	1	4	1	6	0	1	5	
1305/1358	3241	33b	6	17	0	10	7	10	7	4	13	
1305/1358	3241	33b	7	9	0	7	2	2	7	1	8	
1305/1358	3241	33b	8	8								
1305/1358	3302	34a	1	0	0	0	0	0	0	0	0	36
1305/1358	3302	34a	2	0	0	0	0	0	0	0	0	
1305/1358	3302	34a	3	0	0	0	0	0	0	0	0	
1305/1358	3302	34a	4	4	0	2	2	4	0	0	4	
1305/1358	3302	34a	5	3	0	2	1	3	0	2	1	
1305/1358	3302	34a	6	18	0	9	9	13	5	4	14	
1305/1358	3302	34a	7	21	1	10	10	15	6	2	19	
1305/1358	3302	34a	8	3								
1305/1358	3314	34b	1	0	0	0	0	0	0	0	0	46
1305/1358	3314	34b	2	0	0	0	0	0	0	0	0	
1305/1358	3314	34b	3	0	0	0	0	0	0	0	0	
1305/1358	3314	34b	4	1	0	0	1	1	0	1	0	

Table D.2 (cont.)

Unit	AM	lv	size	#	unpat	speckle	otherpat	CaCO3Y	CaCO3N	BurnY	BurnN	total
1305/1358	3314	34b	5	4	0	2	2	4	0	0	4	
1305/1358	3314	34b	6	10	1	4	5	5	5	2	8	
1305/1358	3314	34b	7	14	0	8	6	10	4	1	13	
1305/1358	3314	34b	8	10								
1305/1358	3356	35a	1	0	0	0	0	0	0	0	0	29
1305/1358	3356	35a	2	0	0	0	0	0	0	0	0	
1305/1358	3356	35a	3	0	0	0	0	0	0	0	0	
1305/1358	3356	35a	4	1	0	1	0	1	0	0	1	
1305/1358	3356	35a	5	6	0	4	2	4	2	0	6	
1305/1358	3356	35a	6	21	0	8	13	15	6	0	21	
1305/1358	3356	35a	7	9	0	5	4	3	6	0	9	
1305/1358	3356	35a	8	3								
1305/1358	3408	35b	1	0	0	0	0	0	0	0	0	37
1305/1358	3408	35b	2	0	0	0	0	0	0	0	0	
1305/1358	3408	35b	3	0	0	0	0	0	0	0	0	
1305/1358	3408	35b	4	0	0	0	0	0	0	0	0	
1305/1358	3408	35b	5	4	0	3	1	2	2	0	4	
1305/1358	3408	35b	6	6	1	4	1	2	4	0	6	
1305/1358	3408	35b	7	14	1	6	7	8	6	0	14	
1305/1358	3408	35b	8	4								
1305/1358	3442	36a	1	0	0	0	0	0	0	0	0	24
1305/1358	3442	36a	2	0	0	0	0	0	0	0	0	
1305/1358	3442	36a	3	0	0	0	0	0	0	0	0	
1305/1358	3442	36a	4	0	0	0	0	0	0	0	0	
1305/1358	3442	36a	5	2	0	1	1	1	1	0	2	
1305/1358	3442	36a	6	6	0	4	2	4	2	1	5	
1305/1358	3442	36a	7	3	1	1	1	2	1	0	3	
1305/1358	3442	36a	8	4								
1305/1358	3477	36b	1	0	0	0	0	0	0	0	0	11
1305/1358	3477	36b	2	0	0	0	0	0	0	0	0	
1305/1358	3477	36b	3	0	0	0	0	0	0	0	0	
1305/1358	3477	36b	4	0	0	0	0	0	0	0	0	
1305/1358	3477	36b	5	1	0	1	0	1	0	0	1	
1305/1358	3477	36b	6	5	0	3	2	5	0	1	4	
1305/1358	3477	36b	7	5	0	2	3	4	1	0	5	
1305/1358	3477	36b	8	3								
1305/1358	3492	37a	1	0	0	0	0	0	0	0	0	11
1305/1358	3492	37a	2	0	0	0	0	0	0	0	0	
1305/1358	3492	37a	3	1	0	0	1	0	1	0	1	
1305/1358	3492	37a	4	0	0	0	0	0	0	0	0	
1305/1358	3492	37a	5	1	0	1	0	1	0	0	1	
1305/1358	3492	37a	6	5	0	4	1	3	2	1	4	
1305/1358	3492	37a	7	4	0	2	2	3	1	0	4	
1305/1358	3492	37a	8	6								
1305/1358	3514	37b	1	0	0	0	0	0	0	0	0	11
1305/1358	3514	37b	2	0	0	0	0	0	0	0	0	
1305/1358	3514	37b	3	1	0	0	1	1	0	0	1	
1305/1358	3514	37b	4	0	0	0	0	0	0	0	0	
1305/1358	3514	37b	5	1	0	0	1	1	0	0	1	
1305/1358	3514	37b	6	1	0	0	1	1	0	0	1	
1305/1358	3514	37b	7	1	0	0	1	0	1	1	0	
1305/1358	3514	37b	8	7								
1305/1358	3541	38a	1	0	0	0	0	0	0	0	0	4

Table D.2 (cont.)

Unit	AM	lv	size	#	unpat	speckle	otherpat	CaCO3Y	CaCO3N	BurnY	BurnN	total
1305/1358	3541	38a	2	0	0	0	0	0	0	0	0	
1305/1358	3541	38a	3	0	0	0	0	0	0	0	0	
1305/1358	3541	38a	4	0	0	0	0	0	0	0	0	
1305/1358	3541	38a	5	1	0	0	1	0	1	1	0	
1305/1358	3541	38a	6	1	0	1	0	1	0	0	1	
1305/1358	3541	38a	7	0	0	0	0	0	0	0	0	
1305/1358	3541	38a	8	3								
1305/1358	3549	38b	1	0	0	0	0	0	0	0	0	2
1305/1358	3549	38b	2	0	0	0	0	0	0	0	0	
1305/1358	3549	38b	3	0	0	0	0	0	0	0	0	
1305/1358	3549	38b	4	0	0	0	0	0	0	0	0	
1305/1358	3549	38b	5	0	0	0	0	0	0	0	0	
1305/1358	3549	38b	6	4	0	1	3	1	3	0	4	
1305/1358	3549	38b	7	2	0	0	2	0	2	0	2	
1305/1358	3549	38b	8									
												6

Table D.3. Size sorting analysis of Block A 2007

Unit	LV	sizeclass	quantity	Unit	LV	sizemod	quantity
13051355	27a	1-3	2	13081355	27a	6	39
13051356	27a	1-3	5	13081356	27a	6	43
13051357	27a	1-3	2	13051355	27a	7	33
13051358	27a	1-3	4	13051356	27a	7	31
13061355	27a	1-3	1	13051357	27a	7	51
13061356	27a	1-3	4	13051358	27a	7	21
13061357	27a	1-3	4	13061355	27a	7	30
13061358	27a	1-3	4	13061356	27a	7	46
13071355	27a	1-3	2	13061357	27a	7	50
13071356	27a	1-3	1	13061358	27a	7	27
13081355	27a	1-3	1	13071355	27a	7	38
13081356	27a	1-3	0	13071356	27a	7	40
13051355	27a	4	11	13081355	27a	7	21
13051356	27a	4	14	13081356	27a	7	34
13051357	27a	4	11	13051355	27b	1-3	3
13051358	27a	4	12	13051356	27b	1-3	2
13061355	27a	4	7	13051357	27b	1-3	1
13061356	27a	4	11	13051358	27b	1-3	3
13061357	27a	4	14	13061355	27b	1-3	1
13061358	27a	4	8	13061356	27b	1-3	3
13071355	27a	4	9	13061357	27b	1-3	2
13071356	27a	4	5	13061358	27b	1-3	4
13081355	27a	4	11	13071355	27b	1-3	1
13081356	27a	4	12	13071356	27b	1-3	1
13051355	27a	5	16	13081355	27b	1-3	1
13051356	27a	5	26	13081356	27b	1-3	0
13051357	27a	5	28	13051355	27b	4	12
13051358	27a	5	20	13051356	27b	4	10
13061355	27a	5	19	13051357	27b	4	6
13061356	27a	5	24	13051358	27b	4	12
13061357	27a	5	27	13061355	27b	4	4
13061358	27a	5	26	13061356	27b	4	17
13071355	27a	5	17	13061357	27b	4	14
13071356	27a	5	20	13061358	27b	4	11
13081355	27a	5	25	13071355	27b	4	7
13081356	27a	5	23	13071356	27b	4	5
13051355	27a	6	43	13081355	27b	4	6
13051356	27a	6	67	13081356	27b	4	7
13051357	27a	6	55	13051355	27b	5	9
13051358	27a	6	49	13051356	27b	5	33
13061355	27a	6	39	13051357	27b	5	12
13061356	27a	6	71	13051358	27b	5	29
13061357	27a	6	90	13061355	27b	5	12
13061358	27a	6	82	13061356	27b	5	20
13071355	27a	6	15	13061357	27b	5	29
13071356	27a	6	37	13061358	27b	5	20

Table D.3 (cont.)

Unit	LV	sizeclass	quantity	Unit	LV	sizemod	quantity
13071355	27b	5	21	13061357	28a	4	10
13071356	27b	5	9	13061358	28a	4	15
13081355	27b	5	18	13071355	28a	4	7
13081356	27b	5	18	13071356	28a	4	2
13051355	27b	6	46	13081355	28a	4	10
13051356	27b	6	57	13081356	28a	4	6
13051357	27b	6	55	13051355	28a	5	13
13051358	27b	6	50	13051356	28a	5	22
13061355	27b	6	55	13051357	28a	5	20
13061356	27b	6	73	13051358	28a	5	25
13061357	27b	6	55	13061355	28a	5	13
13061358	27b	6	40	13061356	28a	5	14
13071355	27b	6	58	13061357	28a	5	28
13071356	27b	6	38	13061358	28a	5	37
13081355	27b	6	67	13071355	28a	5	15
13081356	27b	6	49	13071356	28a	5	14
13051355	27b	7	34	13081355	28a	5	17
13051356	27b	7	59	13081356	28a	5	16
13051357	27b	7	44	13051355	28a	6	48
13051358	27b	7	39	13051356	28a	6	55
13061355	27b	7	24	13051357	28a	6	56
13061356	27b	7	54	13051358	28a	6	62
13061357	27b	7	31	13061355	28a	6	36
13061358	27b	7	32	13061356	28a	6	54
13071355	27b	7	38	13061357	28a	6	65
13071356	27b	7	36	13061358	28a	6	59
13081355	27b	7	36	13071355	28a	6	21
13081356	27b	7	36	13071356	28a	6	42
13051355	28a	1-3	0	13081355	28a	6	32
13051356	28a	1-3	1	13081356	28a	6	34
13051357	28a	1-3	1	13051355	28a	7	26
13051358	28a	1-3	4	13051356	28a	7	31
13061355	28a	1-3	0	13051357	28a	7	46
13061356	28a	1-3	1	13051358	28a	7	31
13061357	28a	1-3	3	13061355	28a	7	41
13061358	28a	1-3	5	13061356	28a	7	50
13071355	28a	1-3	0	13061357	28a	7	36
13071356	28a	1-3	0	13061358	28a	7	48
13081355	28a	1-3	0	13071355	28a	7	6
13081356	28a	1-3	0	13071356	28a	7	34
13051355	28a	4	6	13081355	28a	7	44
13051356	28a	4	9	13081356	28a	7	41
13051357	28a	4	9	13051355	28b	1-3	3
13051358	28a	4	9	13051356	28b	1-3	0
13061355	28a	4	6	13051357	28b	1-3	2
13061356	28a	4	14	13051358	28b	1-3	1

Table D.3 (cont.)

Unit	LV	sizeclass	quantity	Unit	LV	sizemod	quantity
13061355	28b	1-3	0	13051357	28b	7	57
13061356	28b	1-3	0	13051358	28b	7	31
13061357	28b	1-3	0	13061355	28b	7	24
13061358	28b	1-3	2	13061356	28b	7	42
13071355	28b	1-3	1	13061357	28b	7	30
13071356	28b	1-3	1	13061358	28b	7	32
13081355	28b	1-3	1	13071355	28b	7	69
13081356	28b	1-3	0	13071356	28b	7	24
13051355	28b	4	9	13081355	28b	7	37
13051356	28b	4	7	13081356	28b	7	25
13051357	28b	4	6	13051355	29a	1-3	1
13051358	28b	4	11	13051356	29a	1-3	2
13061355	28b	4	6	13051357	29a	1-3	1
13061356	28b	4	6	13051358	29a	1-3	3
13061357	28b	4	14	13061355	29a	1-3	0
13061358	28b	4	10	13061356	29a	1-3	3
13071355	28b	4	4	13061357	29a	1-3	3
13071356	28b	4	2	13061358	29a	1-3	0
13081355	28b	4	5	13071355	29a	1-3	1
13081356	28b	4	5	13071356	29a	1-3	2
13051355	28b	5	20	13081355	29a	1-3	0
13051356	28b	5	13	13081356	29a	1-3	0
13051357	28b	5	31	13051355	29a	4	7
13051358	28b	5	28	13051356	29a	4	12
13061355	28b	5	17	13051357	29a	4	9
13061356	28b	5	17	13051358	29a	4	11
13061357	28b	5	19	13061355	29a	4	8
13061358	28b	5	12	13061356	29a	4	5
13071355	28b	5	18	13061357	29a	4	9
13071356	28b	5	7	13061358	29a	4	6
13081355	28b	5	11	13071355	29a	4	9
13081356	28b	5	15	13071356	29a	4	1
13051355	28b	6	49	13081355	29a	4	0
13051356	28b	6	61	13081356	29a	4	5
13051357	28b	6	60	13051355	29a	5	15
13051358	28b	6	41	13051356	29a	5	14
13061355	28b	6	50	13051357	29a	5	21
13061356	28b	6	43	13051358	29a	5	23
13061357	28b	6	53	13061355	29a	5	9
13061358	28b	6	57	13061356	29a	5	15
13071355	28b	6	96	13061357	29a	5	17
13071356	28b	6	34	13061358	29a	5	11
13081355	28b	6	42	13071355	29a	5	16
13081356	28b	6	36	13071356	29a	5	16
13051355	28b	7	41	13081355	29a	5	11
13051356	28b	7	39	13081356	29a	5	15

Table D.3 (cont.)

Unit	LV	sizeclass	quantity	Unit	LV	sizemod	quantity
13051355	29a	6	42	13081355	29b	4	6
13051356	29a	6	61	13081356	29b	4	3
13051357	29a	6	32	13051355	29b	5	9
13051358	29a	6	51	13051356	29b	5	17
13061355	29a	6	46	13051357	29b	5	21
13061356	29a	6	43	13051358	29b	5	19
13061357	29a	6	66	13061355	29b	5	9
13061358	29a	6	40	13061356	29b	5	15
13071355	29a	6	41	13061357	29b	5	20
13071356	29a	6	41	13061358	29b	5	24
13081355	29a	6	42	13071355	29b	5	7
13081356	29a	6	48	13071356	29b	5	7
13051355	29a	7	21	13081355	29b	5	14
13051356	29a	7	41	13081356	29b	5	10
13051357	29a	7	21	13051355	29b	6	24
13051358	29a	7	33	13051356	29b	6	51
13061355	29a	7	42	13051357	29b	6	46
13061356	29a	7	38	13051358	29b	6	42
13061357	29a	7	39	13061355	29b	6	27
13061358	29a	7	29	13061356	29b	6	38
13071355	29a	7	29	13061357	29b	6	37
13071356	29a	7	23	13061358	29b	6	60
13081355	29a	7	18	13071355	29b	6	32
13081356	29a	7	45	13071356	29b	6	23
13051355	29b	1-3	0	13081355	29b	6	15
13051356	29b	1-3	2	13081356	29b	6	29
13051357	29b	1-3	0	13051355	29b	7	17
13051358	29b	1-3	5	13051356	29b	7	43
13061355	29b	1-3	0	13051357	29b	7	29
13061356	29b	1-3	2	13051358	29b	7	31
13061357	29b	1-3	2	13061355	29b	7	20
13061358	29b	1-3	1	13061356	29b	7	37
13071355	29b	1-3	1	13061357	29b	7	40
13071356	29b	1-3	2	13061358	29b	7	48
13081355	29b	1-3	0	13071355	29b	7	37
13081356	29b	1-3	0	13071356	29b	7	28
13051355	29b	4	5	13081355	29b	7	30
13051356	29b	4	5	13081356	29b	7	12
13051357	29b	4	9	13051355	30a	1-3	0
13051358	29b	4	18	13051356	30a	1-3	0
13061355	29b	4	2	13051357	30a	1-3	0
13061356	29b	4	2	13051358	30a	1-3	0
13061357	29b	4	9	13061355	30a	1-3	0
13061358	29b	4	14	13061356	30a	1-3	0
13071355	29b	4	6	13061357	30a	1-3	3
13071356	29b	4	4	13061358	30a	1-3	0

Table D.3 (cont.)

Unit	LV	sizeclass	quantity	Unit	LV	sizemod	quantity
13071355	30a	1-3	1	13061357	30a	7	39
13071356	30a	1-3	0	13061358	30a	7	27
13081355	30a	1-3	0	13071355	30a	7	27
13081356	30a	1-3	1	13071356	30a	7	27
13051355	30a	4	7	13081355	30a	7	20
13051356	30a	4	5	13081356	30a	7	38
13051357	30a	4	6	13051355	30b	1-3	1
13051358	30a	4	15	13051356	30b	1-3	3
13061355	30a	4	2	13051357	30b	1-3	1
13061356	30a	4	8	13051358	30b	1-3	0
13061357	30a	4	8	13061355	30b	1-3	0
13061358	30a	4	10	13061356	30b	1-3	2
13071355	30a	4	6	13061357	30b	1-3	3
13071356	30a	4	2	13061358	30b	1-3	2
13081355	30a	4	3	13071355	30b	1-3	7
13081356	30a	4	3	13071356	30b	1-3	1
13051355	30a	5	15	13081355	30b	1-3	0
13051356	30a	5	19	13081356	30b	1-3	0
13051357	30a	5	14	13051355	30b	4	5
13051358	30a	5	17	13051356	30b	4	12
13061355	30a	5	6	13051357	30b	4	4
13061356	30a	5	14	13051358	30b	4	7
13061357	30a	5	21	13061355	30b	4	3
13061358	30a	5	21	13061356	30b	4	7
13071355	30a	5	11	13061357	30b	4	2
13071356	30a	5	11	13061358	30b	4	8
13081355	30a	5	6	13071355	30b	4	15
13081356	30a	5	9	13071356	30b	4	5
13051355	30a	6	39	13081355	30b	4	3
13051356	30a	6	59	13081356	30b	4	8
13051357	30a	6	44	13051355	30b	5	17
13051358	30a	6	48	13051356	30b	5	17
13061355	30a	6	28	13051357	30b	5	13
13061356	30a	6	43	13051358	30b	5	21
13061357	30a	6	53	13061355	30b	5	6
13061358	30a	6	35	13061356	30b	5	12
13071355	30a	6	36	13061357	30b	5	11
13071356	30a	6	32	13061358	30b	5	17
13081355	30a	6	28	13071355	30b	5	35
13081356	30a	6	34	13071356	30b	5	8
13051355	30a	7	20	13081355	30b	5	8
13051356	30a	7	37	13081356	30b	5	11
13051357	30a	7	20	13051355	30b	6	49
13051358	30a	7	28	13051356	30b	6	51
13061355	30a	7	10	13051357	30b	6	36
13061356	30a	7	32	13051358	30b	6	49

Table D.3 (cont.)

Unit	LV	sizeclass	quantity	Unit	LV	sizemod	quantity
13061355	30b	6	14	13051357	31a	5	12
13061356	30b	6	32	13051358	31a	5	16
13061357	30b	6	26	13061355	31a	5	8
13061358	30b	6	52	13061356	31a	5	9
13071355	30b	6	25	13061357	31a	5	15
13071356	30b	6	35	13061358	31a	5	16
13081355	30b	6	33	13071355	31a	5	6
13081356	30b	6	37	13071356	31a	5	8
13051355	30b	7	24	13081355	31a	5	2
13051356	30b	7	32	13081356	31a	5	12
13051357	30b	7	27	13051355	31a	6	28
13051358	30b	7	28	13051356	31a	6	33
13061355	30b	7	12	13051357	31a	6	32
13061356	30b	7	21	13051358	31a	6	32
13061357	30b	7	31	13061355	31a	6	23
13061358	30b	7	20	13061356	31a	6	29
13071355	30b	7	0	13061357	31a	6	28
13071356	30b	7	17	13061358	31a	6	41
13081355	30b	7	26	13071355	31a	6	31
13081356	30b	7	29	13071356	31a	6	28
13051355	31a	1-3	1	13081355	31a	6	7
13051356	31a	1-3	0	13081356	31a	6	17
13051357	31a	1-3	1	13051355	31a	7	16
13051358	31a	1-3	1	13051356	31a	7	38
13061355	31a	1-3	0	13051357	31a	7	12
13061356	31a	1-3	0	13051358	31a	7	32
13061357	31a	1-3	35	13061355	31a	7	13
13061358	31a	1-3	1	13061356	31a	7	23
13071355	31a	1-3	0	13061357	31a	7	32
13071356	31a	1-3	0	13061358	31a	7	25
13081355	31a	1-3	0	13071355	31a	7	39
13081356	31a	1-3	2	13071356	31a	7	11
13051355	31a	4	4	13081355	31a	7	8
13051356	31a	4	5	13081356	31a	7	11
13051357	31a	4	4	13051355	31b	1-3	1
13051358	31a	4	8	13051356	31b	1-3	1
13061355	31a	4	4	13051357	31b	1-3	1
13061356	31a	4	9	13051358	31b	1-3	0
13061357	31a	4	12	13061355	31b	1-3	0
13061358	31a	4	7	13061356	31b	1-3	0
13071355	31a	4	1	13061357	31b	1-3	0
13071356	31a	4	0	13061358	31b	1-3	1
13081355	31a	4	2	13071355	31b	1-3	0
13081356	31a	4	3	13071356	31b	1-3	0
13051355	31a	5	7	13081355	31b	1-3	0
13051356	31a	5	11	13081356	31b	1-3	0

Table D.3 (cont.)

Unit	LV	sizeclass	quantity	Unit	LV	sizemod	quantity
13051355	31b	4	4	13081355	31b	7	19
13051356	31b	4	5	13081356	31b	7	22
13051357	31b	4	1	13051355	32a	1-3	0
13051358	31b	4	7	13051356	32a	1-3	1
13061355	31b	4	5	13051357	32a	1-3	2
13061356	31b	4	3	13051358	32a	1-3	0
13061357	31b	4	10	13061355	32a	1-3	0
13061358	31b	4	7	13061356	32a	1-3	0
13071355	31b	4	0	13061357	32a	1-3	0
13071356	31b	4	3	13061358	32a	1-3	3
13081355	31b	4	0	13071355	32a	1-3	0
13081356	31b	4	1	13071356	32a	1-3	0
13051355	31b	5	10	13081355	32a	1-3	0
13051356	31b	5	11	13081356	32a	1-3	2
13051357	31b	5	15	13051355	32a	4	2
13051358	31b	5	12	13051356	32a	4	5
13061355	31b	5	5	13051357	32a	4	2
13061356	31b	5	9	13051358	32a	4	8
13061357	31b	5	12	13061355	32a	4	0
13061358	31b	5	15	13061356	32a	4	5
13071355	31b	5	6	13061357	32a	4	3
13071356	31b	5	7	13061358	32a	4	5
13081355	31b	5	1	13071355	32a	4	2
13081356	31b	5	12	13071356	32a	4	1
13051355	31b	6	22	13081355	32a	4	2
13051356	31b	6	35	13081356	32a	4	4
13051357	31b	6	31	13051355	32a	5	8
13051358	31b	6	35	13051356	32a	5	15
13061355	31b	6	13	13051357	32a	5	9
13061356	31b	6	26	13051358	32a	5	13
13061357	31b	6	30	13061355	32a	5	1
13061358	31b	6	36	13061356	32a	5	4
13071355	31b	6	25	13061357	32a	5	12
13071356	31b	6	24	13061358	32a	5	12
13081355	31b	6	21	13071355	32a	5	3
13081356	31b	6	15	13071356	32a	5	6
13051355	31b	7	9	13081355	32a	5	4
13051356	31b	7	27	13081356	32a	5	12
13051357	31b	7	18	13051355	32a	6	19
13051358	31b	7	35	13051356	32a	6	32
13061355	31b	7	13	13051357	32a	6	27
13061356	31b	7	22	13051358	32a	6	42
13061357	31b	7	30	13061355	32a	6	6
13061358	31b	7	28	13061356	32a	6	29
13071355	31b	7	22	13061357	32a	6	28
13071356	31b	7	15	13061358	32a	6	40

Table D.3 (cont.)

Unit	LV	sizeclass	quantity	Unit	LV	sizemod	quantity
13071355	32a	6	7	13061357	32b	5	9
13071356	32a	6	22	13061358	32b	5	21
13081355	32a	6	7	13071355	32b	5	7
13081356	32a	6	18	13071356	32b	5	3
13051355	32a	7	27	13081355	32b	5	4
13051356	32a	7	27	13081356	32b	5	5
13051357	32a	7	20	13051355	32b	6	18
13051358	32a	7	22	13051356	32b	6	32
13061355	32a	7	7	13051357	32b	6	23
13061356	32a	7	19	13051358	32b	6	27
13061357	32a	7	25	13061355	32b	6	13
13061358	32a	7	21	13061356	32b	6	16
13071355	32a	7	5	13061357	32b	6	19
13071356	32a	7	21	13061358	32b	6	42
13081355	32a	7	6	13071355	32b	6	6
13081356	32a	7	28	13071356	32b	6	24
13051355	32b	1-3	0	13081355	32b	6	7
13051356	32b	1-3	0	13081356	32b	6	19
13051357	32b	1-3	2	13051355	32b	7	13
13051358	32b	1-3	1	13051356	32b	7	35
13061355	32b	1-3	0	13051357	32b	7	25
13061356	32b	1-3	1	13051358	32b	7	24
13061357	32b	1-3	1	13061355	32b	7	11
13061358	32b	1-3	1	13061356	32b	7	28
13071355	32b	1-3	0	13061357	32b	7	19
13071356	32b	1-3	0	13061358	32b	7	25
13081355	32b	1-3	0	13071355	32b	7	16
13081356	32b	1-3	0	13071356	32b	7	21
13051355	32b	4	4	13081355	32b	7	12
13051356	32b	4	6	13081356	32b	7	21
13051357	32b	4	1	13051355	33a	1-3	0
13051358	32b	4	1	13051356	33a	1-3	1
13061355	32b	4	1	13051357	33a	1-3	0
13061356	32b	4	1	13051358	33a	1-3	1
13061357	32b	4	4	13061355	33a	1-3	0
13061358	32b	4	3	13061356	33a	1-3	0
13071355	32b	4	2	13061357	33a	1-3	0
13071356	32b	4	1	13061358	33a	1-3	0
13081355	32b	4	0	13071355	33a	1-3	1
13081356	32b	4	1	13071356	33a	1-3	1
13051355	32b	5	4	13081355	33a	1-3	0
13051356	32b	5	13	13081356	33a	1-3	0
13051357	32b	5	5	13051355	33a	4	0
13051358	32b	5	11	13051356	33a	4	7
13061355	32b	5	2	13051357	33a	4	1
13061356	32b	5	12	13051358	33a	4	8

Table D.3 (cont.)

Unit	LV	sizeclass	quantity	Unit	LV	sizemod	quantity
13061355	33a	4	0	13051357	33b	1-3	1
13061356	33a	4	2	13051358	33b	1-3	1
13061357	33a	4	2	13061355	33b	1-3	0
13061358	33a	4	4	13061356	33b	1-3	1
13071355	33a	4	1	13061357	33b	1-3	1
13071356	33a	4	1	13061358	33b	1-3	0
13081355	33a	4	0	13071355	33b	1-3	0
13081356	33a	4	0	13071356	33b	1-3	0
13051355	33a	5	3	13081355	33b	1-3	0
13051356	33a	5	11	13081356	33b	1-3	0
13051357	33a	5	2	13051355	33b	4	0
13051358	33a	5	11	13051356	33b	4	3
13061355	33a	5	2	13051357	33b	4	2
13061356	33a	5	5	13051358	33b	4	3
13061357	33a	5	6	13061355	33b	4	0
13061358	33a	5	6	13061356	33b	4	3
13071355	33a	5	0	13061357	33b	4	0
13071356	33a	5	2	13061358	33b	4	4
13081355	33a	5	0	13071355	33b	4	0
13081356	33a	5	5	13071356	33b	4	3
13051355	33a	6	10	13081355	33b	4	0
13051356	33a	6	22	13081356	33b	4	1
13051357	33a	6	11	13051355	33b	5	0
13051358	33a	6	28	13051356	33b	5	7
13061355	33a	6	6	13051357	33b	5	3
13061356	33a	6	12	13051358	33b	5	6
13061357	33a	6	16	13061355	33b	5	2
13061358	33a	6	18	13061356	33b	5	3
13071355	33a	6	2	13061357	33b	5	2
13071356	33a	6	14	13061358	33b	5	13
13081355	33a	6	3	13071355	33b	5	0
13081356	33a	6	20	13071356	33b	5	2
13051355	33a	7	10	13081355	33b	5	0
13051356	33a	7	11	13081356	33b	5	1
13051357	33a	7	8	13051355	33b	6	15
13051358	33a	7	15	13051356	33b	6	26
13061355	33a	7	5	13051357	33b	6	18
13061356	33a	7	12	13051358	33b	6	17
13061357	33a	7	2	13061355	33b	6	1
13061358	33a	7	15	13061356	33b	6	15
13071355	33a	7	4	13061357	33b	6	15
13071356	33a	7	11	13061358	33b	6	28
13081355	33a	7	4	13071355	33b	6	4
13081356	33a	7	13	13071356	33b	6	8
13051355	33b	1-3	0	13081355	33b	6	4
13051356	33b	1-3	0	13081356	33b	6	15

Table D.3 (cont.)

Unit	LV	sizeclass	quantity	Unit	LV	sizemod	quantity
13051355	33b	7	5	13081355	34a	5	1
13051356	33b	7	25	13081356	34a	5	5
13051357	33b	7	9	13051355	34a	6	6
13051358	33b	7	9	13051356	34a	6	25
13061355	33b	7	1	13051357	34a	6	13
13061356	33b	7	11	13051358	34a	6	18
13061357	33b	7	18	13061355	34a	6	3
13061358	33b	7	17	13061356	34a	6	12
13071355	33b	7	6	13061357	34a	6	11
13071356	33b	7	10	13061358	34a	6	22
13081355	33b	7	2	13071355	34a	6	4
13081356	33b	7	16	13071356	34a	6	4
13051355	34a	1-3	0	13081355	34a	6	3
13051356	34a	1-3	2	13081356	34a	6	10
13051357	34a	1-3	1	13051355	34a	7	4
13051358	34a	1-3	0	13051356	34a	7	15
13061355	34a	1-3	1	13051357	34a	7	6
13061356	34a	1-3	0	13051358	34a	7	21
13061357	34a	1-3	1	13061355	34a	7	2
13061358	34a	1-3	0	13061356	34a	7	5
13071355	34a	1-3	0	13061357	34a	7	12
13071356	34a	1-3	0	13061358	34a	7	14
13081355	34a	1-3	0	13071355	34a	7	3
13081356	34a	1-3	0	13071356	34a	7	17
13051355	34a	4	1	13081355	34a	7	1
13051356	34a	4	4	13081356	34a	7	13
13051357	34a	4	0	13051355	34b	1-3	0
13051358	34a	4	4	13051356	34b	1-3	0
13061355	34a	4	0	13051357	34b	1-3	1
13061356	34a	4	0	13051358	34b	1-3	0
13061357	34a	4	5	13061355	34b	1-3	0
13061358	34a	4	6	13061356	34b	1-3	0
13071355	34a	4	1	13061357	34b	1-3	0
13071356	34a	4	1	13061358	34b	1-3	0
13081355	34a	4	0	13071355	34b	1-3	0
13081356	34a	4	2	13071356	34b	1-3	0
13051355	34a	5	3	13081355	34b	1-3	0
13051356	34a	5	4	13081356	34b	1-3	0
13051357	34a	5	3	13051355	34b	4	0
13051358	34a	5	3	13051356	34b	4	0
13061355	34a	5	0	13051357	34b	4	0
13061356	34a	5	2	13051358	34b	4	1
13061357	34a	5	10	13061355	34b	4	1
13061358	34a	5	9	13061356	34b	4	2
13071355	34a	5	0	13061357	34b	4	1
13071356	34a	5	4	13061358	34b	4	0

Table D.3 (cont.)

Unit	LV	sizeclass	quantity	Unit	LV	sizemod	quantity
13071355	34b	4	0	13061357	35a	1-3	0
13071356	34b	4	0	13061358	35a	1-3	1
13081355	34b	4	0	13071355	35a	1-3	0
13081356	34b	4	0	13071356	35a	1-3	1
13051355	34b	5	0	13081355	35a	1-3	0
13051356	34b	5	4	13081356	35a	1-3	0
13051357	34b	5	4	13051355	35a	4	0
13051358	34b	5	4	13051356	35a	4	1
13061355	34b	5	0	13051357	35a	4	1
13061356	34b	5	2	13051358	35a	4	1
13061357	34b	5	3	13061355	35a	4	0
13061358	34b	5	11	13061356	35a	4	1
13071355	34b	5	0	13061357	35a	4	1
13071356	34b	5	1	13061358	35a	4	2
13081355	34b	5	0	13071355	35a	4	0
13081356	34b	5	3	13071356	35a	4	0
13051355	34b	6	6	13081355	35a	4	1
13051356	34b	6	13	13081356	35a	4	1
13051357	34b	6	8	13051355	35a	5	0
13051358	34b	6	10	13051356	35a	5	3
13061355	34b	6	0	13051357	35a	5	1
13061356	34b	6	9	13051358	35a	5	6
13061357	34b	6	14	13061355	35a	5	2
13061358	34b	6	23	13061356	35a	5	1
13071355	34b	6	0	13061357	35a	5	3
13071356	34b	6	8	13061358	35a	5	4
13081355	34b	6	0	13071355	35a	5	0
13081356	34b	6	12	13071356	35a	5	1
13051355	34b	7	7	13081355	35a	5	0
13051356	34b	7	9	13081356	35a	5	0
13051357	34b	7	13	13051355	35a	6	2
13051358	34b	7	14	13051356	35a	6	2
13061355	34b	7	0	13051357	35a	6	5
13061356	34b	7	7	13051358	35a	6	21
13061357	34b	7	10	13061355	35a	6	1
13061358	34b	7	16	13061356	35a	6	2
13071355	34b	7	0	13061357	35a	6	14
13071356	34b	7	3	13061358	35a	6	8
13081355	34b	7	0	13071355	35a	6	0
13081356	34b	7	4	13071356	35a	6	5
13051355	35a	1-3	0	13081355	35a	6	0
13051356	35a	1-3	0	13081356	35a	6	2
13051357	35a	1-3	0	13051355	35a	7	0
13051358	35a	1-3	0	13051356	35a	7	6
13061355	35a	1-3	0	13051357	35a	7	1
13061356	35a	1-3	0	13051358	35a	7	9

Table D.3 (cont.)

Unit	LV	sizeclass	quantity	Unit	LV	sizemod	quantity
13061355	35a	7	3	13051357	35b	6	2
13061356	35a	7	2	13051358	35b	6	6
13061357	35a	7	15	13061355	35b	6	0
13061358	35a	7	11	13061356	35b	6	5
13071355	35a	7	0	13061357	35b	6	25
13071356	35a	7	1	13061358	35b	6	10
13081355	35a	7	0	13071355	35b	6	0
13081356	35a	7	2	13071356	35b	6	1
13051355	35b	1-3	0	13081355	35b	6	0
13051356	35b	1-3	0	13081356	35b	6	3
13051357	35b	1-3	0	13051355	35b	7	0
13051358	35b	1-3	0	13051356	35b	7	2
13061355	35b	1-3	0	13051357	35b	7	7
13061356	35b	1-3	0	13051358	35b	7	14
13061357	35b	1-3	0	13061355	35b	7	0
13061358	35b	1-3	0	13061356	35b	7	1
13071355	35b	1-3	0	13061357	35b	7	8
13071356	35b	1-3	1	13061358	35b	7	10
13081355	35b	1-3	0	13071355	35b	7	1
13081356	35b	1-3	0	13071356	35b	7	2
13051355	35b	4	0	13081355	35b	7	0
13051356	35b	4	0	13081356	35b	7	1
13051357	35b	4	1	13051355	36a	1-3	0
13051358	35b	4	0	13051356	36a	1-3	0
13061355	35b	4	0	13051357	36a	1-3	1
13061356	35b	4	1	13051358	36a	1-3	0
13061357	35b	4	2	13061355	36a	1-3	0
13061358	35b	4	0	13061356	36a	1-3	0
13071355	35b	4	1	13061357	36a	1-3	0
13071356	35b	4	1	13061358	36a	1-3	0
13081355	35b	4	0	13071356	36a	1-3	0
13081356	35b	4	0	13081356	36a	1-3	0
13051355	35b	5	1	13051355	36a	4	0
13051356	35b	5	0	13051356	36a	4	0
13051357	35b	5	2	13051357	36a	4	0
13051358	35b	5	4	13051358	36a	4	0
13061355	35b	5	0	13061355	36a	4	0
13061356	35b	5	0	13061356	36a	4	1
13061357	35b	5	9	13061357	36a	4	1
13061358	35b	5	3	13061358	36a	4	4
13071355	35b	5	0	13071356	36a	4	0
13071356	35b	5	0	13081356	36a	4	0
13081355	35b	5	0	13051355	36a	5	0
13081356	35b	5	0	13051356	36a	5	0
13051355	35b	6	0	13051357	36a	5	1
13051356	35b	6	3	13051358	36a	5	2

Table D.3 (cont.)

Unit	LV	sizeclass	quantity	Unit	LV	sizemod	quantity
13061355	36a	5	0	13051357	36b	5	0
13061356	36a	5	0	13051358	36b	5	1
13061357	36a	5	3	13061355	36b	5	0
13061358	36a	5	7	13061356	36b	5	0
13071356	36a	5	0	13061357	36b	5	1
13081356	36a	5	0	13061358	36b	5	0
13051355	36a	6	1	13081356	36b	5	0
13051356	36a	6	2	13051355	36b	6	0
13051357	36a	6	0	13051356	36b	6	0
13051358	36a	6	6	13051357	36b	6	0
13061355	36a	6	0	13051358	36b	6	5
13061356	36a	6	0	13061355	36b	6	0
13061357	36a	6	11	13061356	36b	6	1
13061358	36a	6	7	13061357	36b	6	6
13071356	36a	6	0	13061358	36b	6	8
13081356	36a	6	1	13081356	36b	6	0
13051355	36a	7	0	13051355	36b	7	2
13051356	36a	7	2	13051356	36b	7	1
13051357	36a	7	4	13051357	36b	7	2
13051358	36a	7	3	13051358	36b	7	5
13061355	36a	7	0	13061355	36b	7	0
13061356	36a	7	1	13061356	36b	7	1
13061357	36a	7	4	13061357	36b	7	6
13061358	36a	7	9	13061358	36b	7	3
13071356	36a	7	0	13081356	36b	7	0
13081356	36a	7	1	13061357	37a	1-3	0
13051355	36b	1-3	0	13061358	37a	1-3	0
13051356	36b	1-3	0	13061357	37a	4	2
13051357	36b	1-3	0	13061358	37a	4	1
13051358	36b	1-3	0	13061357	37a	5	0
13061355	36b	1-3	0	13061358	37a	5	0
13061356	36b	1-3	0	13061357	37a	6	3
13061357	36b	1-3	0	13061358	37a	6	1
13061358	36b	1-3	1	13061357	37a	7	0
13081356	36b	1-3	0	13061358	37a	7	5
13051355	36b	4	0	13061357	37b	1-3	0
13051356	36b	4	0	13061358	37b	1-3	0
13051357	36b	4	1	13061357	37b	4	0
13051358	36b	4	0	13061358	37b	4	1
13061355	36b	4	0	13061357	37b	5	0
13061356	36b	4	0	13061358	37b	5	0
13061357	36b	4	0	13061357	37b	6	0
13061358	36b	4	0	13061358	37b	6	4
13081356	36b	4	0	13061357	37b	7	0
13051355	36b	5	0	13061358	37b	7	2
13051356	36b	5	0	13061357	38a	1-3	0

Table D.3 (cont.)

Unit	LV	sizeclass	quantity
13061358	38a	1-3	0
13061357	38a	4	0
13061358	38a	4	0
13061357	38a	5	0
13061358	38a	5	1
13061357	38a	6	4
13061358	38a	6	2
13061357	38a	7	0
13061358	38a	7	2
13061358	38b	1-3	0
13061358	38b	4	0
13061358	38b	5	1
13061358	38b	6	0
13061358	38b	7	3

Table D.4. 1304N/1356E 50-by-50 data: Rocks

AM no	LV	weight1	weight2	weight3	weight4	weight5	weight6	weight7	weight8
4095	12a	0	0	0	26	20.4	17.4	20.4	6.5
4096	12b	118.9	152.9	94.9	101.8	75.9	64.5	61.7	21.5
4097	13a	0	32.9	80.8	78.2	75.3	79.8	81.3	36.2
4098	13b	798.5	121.7	153.9	103.7	90.8	75	54.8	17.2
4099	14a	0	27.2	25.4	102	76.3	92.2	65.6	15.3
4100	14b	0	27.8	25.1	111.4	68.7	90.6	77.9	42.4
4101	15a	0	0	10.5	112.5	25.5	59.4	60.7	37
4102	15b	0	0	10	27.5	20.7	38.2	45.6	30.1
4112	16a	0	0	30.1	32.1	22.8	37.4	48.1	31.3
4113	16b	0	0	8.8	8.2	18	39.7	39.1	26
4114	17a	0	0	51.3	42.3	23.1	52.4	66.7	44
4115	17b	0	0	0	18.7	33.9	50.7	43.4	26.6
4116	18a	0	0	14.9	8.8	44.6	51.5	57.1	33.2
4117	18b	0	0	11.9	19.9	42.3	64.4	80.8	48.8
4118	19a	0	23	28.9	15.9	21.8	53.7	76.8	43.2
4119	19b	0	0	49.7	22.6	49.4	22.6	49.4	73.8
4137	20a	0	0	0	23.3	46.1	62.6	63	40.4
4142	20b	0	0	0	12	40.9	74.3	94.6	44.3
4143	21a	0	0	0	33.4	67	88.3	103.5	50.6
4144	21b	0	20.3	9.2	16.5	75.3	71	84.6	36.9
4145	22a	0	0	0	49.1	42.8	86.8	102.1	58.3
4146	22b	0	0	0	52.9	91.8	97.8	98.4	50.1
4147	23a	0	31.1	0	23.1	44.7	75	71.8	33.8
4148	23b	0	0	0	26.9	49.9	62.1	53.4	30.7
4162	24a	0	0	8.1	34.2	54.9	93.1	105.5	56.3
4163	24b	0	55.1	0	40.9	46.9	99.1	105.3	52
4164	25a	0	60.4	9.2	51.3	72.8	98.9	119.2	53.5
4165	25b	0	0	18.5	38.8	56.8	126.9	142.6	81.2
4190	26a	0	0	7.5	21.8	71	111.1	139.8	77
4191	26b	0	0	18.1	22.4	50.7	97.2	130.3	65.2
4192	27a	0	0	0	37.9	57.5	85.9	121.5	58.9
4193	27b	0	0	0	36.6	50.1	73.2	104.9	60.9
4221	28a	0	0	0	31.6	46.9	63.5	129.3	58.5
4222	28b	0	0	0	20.6	44.5	73.2	82.8	16.9
4269	29a	0	0	26.7	36.4	48.8	57.8	77.7	47.7
4270	29b	0	0	0	29.8	19.3	67.8	148.7	109.5
4287	30a	0	0	0	21.6	33.4	50.1	131.1	94

AM no	LV	weight1	weight2	weight3	weight4	weight5	weight6	weight7	weight8
4288	30b	0	0	0	24.4	27	43.5	91.9	64.3
4270	31a	0	0	10.3	19.6	25.8	52	90.2	49.9
4434	31b	0	0	0	41.7	27.8	61.4	93	52.3
4476	32a	0	0	9.1	14.6	13.9	41.8	73.8	41.6
4586	32b	0	0	0	6.1	13.4	51	82	25.5
4648	33a	0	0	32	3.7	10.8	27.5	82.1	27.5
4741	33b	0	0	11.9	0	10.1	23.4	61.5	44
4770	34a	0	0	0	8.4	9.9	13.1	52.8	28.9
4884	34b	0	0	0	30.6	16	33.4	115.2	57.9
4951	35a	0	23.8	11.4	4.6	17.1	41.4	105.2	55.6
4961	35b	0	0	10.8	52.5	23.2	35.4	156.3	120.4
5058	36a	0	0	52.4	71.1	20	47.9	84.8	31.5
5128	36b	0	65.2	0	67.3	78.5	226.7	250.8	20.3

Table D.5. 1304N/1356E 50-by-50 data: $CaCO_3$

AM no	LV	weight1	weight2	weight3	weight4	weight5	weight6	weight7	weight8
4095	12a	0	0	0	0	0	0	0	0
4096	12b	0	0	0	0	0	0	0	0
4097	13a	0	0	0	0	0	0	0	0
4098	13b	0	0	0	0	0	0	0	0
4099	14a	0	0	0	0	0	0	0	0
4100	14b	0	0	0	0	0	0	0	0
4101	15a	0	0	0	0	0	0	0	0
4102	15b	0	0	0	0	0	0	0	0
4112	16a	0	0	0	0	0	0	0	0
4113	16b	0	0	0	0	0	0	0	0
4114	17a	0	0	0	0	0	0	0	0
4115	17b	0	0	0	0	0	0	0	0
4116	18a	0	0	0	0	0	0	0	0
4117	18b	0	0	0	0	0	0	0	0
4118	19a	0	0	0	0	0	0	0	0
4119	19b	0	0	0	0	0	0	0	0
4137	20a	0	0	0	0	0	0	0	0
4142	20b	0	0	0	0	0	0	0	0
4143	21a	0	0	0	0	0	0	0	0
4144	21b	0	0	0	0	0	0	0	0
4145	22a	0	0	0	0	0	0	0	0
4146	22b	0	0	0	0	0	0	0	0
4147	23a	0	0	0	0	0	0	0	0
4148	23b	0	0	0	0	0	0	0	0
4162	24a	0	0	0	0	0	0	0	0
4163	24b	0	0	0	0	0	0	0	0
4164	25a	0	0	0	0	0	5.2	19.5	5
4165	25b	0	0	0	0	0	8.9	18.1	1.3
4190	26a	0	0	0	0	1.2	11	55.5	11.2
4191	26b	0	0	0	0	0	11.4	65.6	15.4
4192	27a	0	0	0	0	0	25.1	109	38.2
4193	27b	0	0	0	0	6.2	35.7	161.7	47.8
4221	28a	0	0	0	0	11.5	77.3	210.2	48.7
4222	28b	0	0	0	0	10.9	75.1	166.9	18.7
4269	29a	0	0	0	0	31.3	102.1	294.6	87.4
4270	29b	0	0	0	0	8.6	95.3	268.3	86.8
4287	30a	0	0	0	0	10.5	105.4	307.9	102.7

AM no	LV	weight1	weight2	weight3	weight4	weight5	weight6	weight7	weight8
4288	30b	0	0	0	3	25.6	168.7	326.4	137.6
4270	31a	0	0	0	0	32.1	138.7	332.2	136.9
4434	31b	0	0	0	16	35.3	227.4	492.3	165.2
4476	32a	0	0	0	3	53.4	185.5	339.3	115.6
4586	32b	0	0	0	3	49.4	218.6	493.3	184
4648	33a	0	0	0	0	56.3	223.9	372.7	129.3
4741	33b	0	0	0	0	68	284.3	471.2	163.4
4770	34a	0	0	0	6.3	50.2	201.2	287.3	104
4884	34b	0	0	0	0	44.8	260.7	388.1	137.6
4951	35a	0	0	0	12.6	21.8	173.3	318.7	106.6
4961	35b	0	0	0	0	28.2	184.6	394.5	172.9
5058	36a	0	0	0	0	27.6	205.4	489.1	292.2
5128	36b	0	0	0	0	0	0	385.7	311.3

Table D.6. 1304N/1356E 50-by-50 data: Artifacts (weight)

AM no	LV	weight1	weight2	weight3	weight4	weight5	weight6	weight7	weight8
4095	12a	0	0	0	9.3	6.5	2.3	2.6	0.6
4096	12b	0	52.8	48.8	13.8	23.4	15.2	11.3	2.4
4097	13a	0	0	22.7	25.3	15.5	25.1	14.1	2.4
4098	13b	0	20.2	20.5	28.5	7.5	9.3	7.2	1.7
4099	14a	0	13.8	22.6	17.6	7.9	9.8	7.1	1
4100	14b	0	0	15.1	23.2	15.8	6.5	7.6	3.9
4101	15a	0	0	25.4	5.7	12.6	7.9	9.5	2.4
4102	15b	0	0	4.8	4.3	4.4	4.7	5	0.9
4112	16a	0	0	5.4	4.7	4.7	6.5	8.4	1.9
4113	16b	0	0	0	3.4	0.9	6	3.8	1
4114	17a	0	0	0	0	6.3	7.8	6.4	1.5
4115	17b	0	0	11.5	4.6	7.8	6.6	5.5	0.9
4116	18a	0	0	4.3	2	5.4	3.1	6.9	1.1
4117	18b	0	10.4	4.3	11.2	6	5.2	4.6	1.9
4118	19a	0	0	10.4	13.7	7.4	5.4	6.5	2
4119	19b	0	0	4.8	3.7	10.8	7.1	6.9	2.8
4137	20a	0	0	0	4	3.6	8.4	4.5	1.4
4142	20b	0	0	3.8	1.8	2.1	7.9	5.4	1.7
4143	21a	0	27.3	10.2	7.1	7.6	5.4	6.1	2.3
4144	21b	0	0	0	3	13.1	5.3	4.5	1
4145	22a	0	0	11.6	3.7	9.9	3.4	8	2.3
4146	22b	0	0	12.2	7.8	4.7	5.6	3.7	0.8
4147	23a	0	0	0	8.3	6.7	7.4	4.5	0.9
4148	23b	0	0	10.3	8.9	7.2	6.9	4.2	0.8
4162	24a	0	0	8.7	12.7	13.9	10.7	7.8	1.4
4163	24b	0	0	0	7.8	8.1	7	6	1.2
4164	25a	0	0	0	11.4	6.4	7.2	6.2	1.3
4165	25b	0	0	0	11.1	6.8	8.3	5.8	1.6
4190	26a	0	0	0	16.9	10.9	4.2	7.5	1.4
4191	26b	0	0	0	8.9	8.7	5.5	8.4	1.7
4192	27a	0	0	0	11.6	5.9	5.9	4.2	1.6
4193	27b	0	0	0	0	6.6	5.7	5.6	1.9
4221	28a	0	0	0	4.9	6.6	8.1	5.2	1.8
4222	28b	0	0	0	5.2	4.2	5.8	2.5	0.7
4269	29a	0	0	0	0	7.2	3.8	4	1
4270	29b	0	0	0	9.9	6.4	1.1	3.8	1.4
4287	30a	0	0	0	1.5	2.4	3.3	3.7	2.1

AM no	LV	weight1	weight2	weight3	weight4	weight5	weight6	weight7	weight8
4288	30b	0	0	5.9	4.5	1.9	2.7	2.2	1.3
4270	31a	0	0	2.1	9.7	2.4	4.2	3.9	0.9
4434	31b	0	0	0	0	3.1	4.4	5	1.2
4476	32a	0	0	4	1.6	3	1.6	1.8	1
4586	32b	0	0	0	0	2.2	2.4	2.9	0.7
4648	33a	0	0	0	0	0	3.2	1.7	0.3
4741	33b	0	0	0	0	0.4	1.4	1.8	0.6
4770	34a	0	0	0	0	0.8	1.2	1.8	0.5
4884	34b	0	0	0	0	0	0	1.2	0.1
4951	35a	0	0	0	0	1.1	0.7	0.5	0.4
4961	35b	0	0	0	0	0	0	0.1	0.1
5058	36a	0	0	0	0	1.2	0	0.7	0.3
5128	36b	0	0	0	0	0	0	0.1	0.1

Table D.7. 1304N/1356E 50-by-50 data: Artifacts (count)

AM no	LV	count123	count1	count2	count3	count4	count5	count6	count7	count8
4095	12a	0	0	0	0	3	4	10	38	26
4096	12b	6	0	1	5	3	21	38	124	111
4097	13a	3	0	0	3	9	12	63	191	134
4098	13b	7	0	1	6	11	11	34	115	95
4099	14a	5	0	1	4	9	11	31	96	58
4100	14b	2	0	0	2	6	11	23	93	225
4101	15a	2	0	0	2	2	6	27	116	131
4102	15b	1	0	0	1	1	6	21	84	60
4112	16a	1	0	0	1	2	4	18	108	96
4113	16b	0	0	0	0	1	1	14	56	48
4114	17a	0	0	0	0	0	7	18	94	89
4115	17b	1	0	0	1	2	3	15	69	40
4116	18a	1	0	0	1	1	7	14	99	61
4117	18b	2	0	1	1	4	7	15	67	110
4118	19a	1	0	0	1	4	9	16	75	107
4119	19b	1	0	0	1	2	8	22	95	144
4137	20a	0	0	0	0	2	4	19	57	72
4142	20b	1	0	0	1	1	2	21	60	72
4143	21a	3	0	1	2	2	7	17	80	109
4144	21b	0	0	0	0	2	12	15	63	57
4145	22a	2	0	0	2	2	10	12	96	103
4146	22b	2	0	0	2	4	6	18	57	46
4147	23a	0	0	0	0	2	8	23	64	58
4148	23b	1	0	0	1	3	6	18	53	47
4162	24a	2	0	0	2	5	13	28	96	69
4163	24b	0	0	0	0	2	8	19	74	70
4164	25a	0	0	0	0	4	5	18	66	65
4165	25b	0	0	0	0	3	7	24	74	97
4190	26a	0	0	0	0	6	10	17	94	87
4191	26b	0	0	0	0	3	6	13	108	93
4192	27a	0	0	0	0	4	5	22	65	97
4193	27b	0	0	0	0	0	6	14	76	123
4221	28a	0	0	0	0	2	6	28	71	83
4222	28b	0	0	0	0	2	5	18	36	44
4269	29a	0	0	0	0	0	6	14	50	59
4270	29b	0	0	0	0	4	8	4	53	81
4287	30a	0	0	0	0	1	3	11	52	112

Table D.7 (cont.)

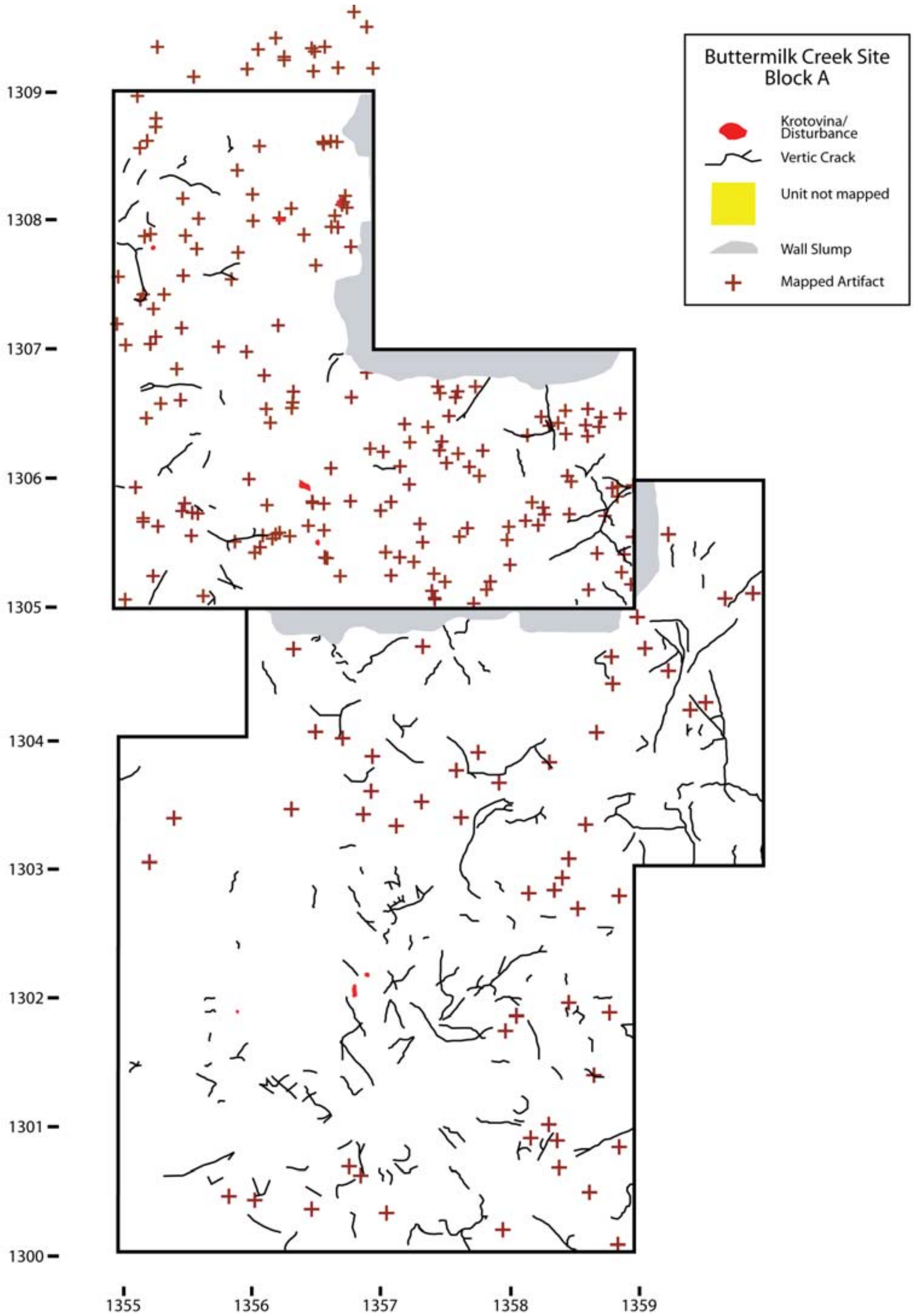
AM no	LV	count123	count1	count2	count3	count4	count5	count6	count7	count8
4288	30b	1	0	0	1	2	3	9	34	71
4270	31a	1	0	0	1	3	2	13	46	49
4434	31b	0	0	0	0	0	4	13	52	43
4476	32a	1	0	0	1	1	3	5	28	55
4586	32b	0	0	0	0	0	1	5	44	36
4648	33a	0	0	0	0	0	0	8	28	18
4741	33b	0	0	0	0	0	1	7	31	32
4770	34a	0	0	0	0	0	1	4	20	24
4884	34b	0	0	0	0	0	0	0	15	20
4951	35a	0	0	0	0	0	1	3	10	21
4961	35b	0	0	0	0	0	0	0	3	18
5058	36a	0	0	0	0	0	1	0	9	15
5128	36b	0	0	0	0	0	0	0	4	7

APPENDIX E

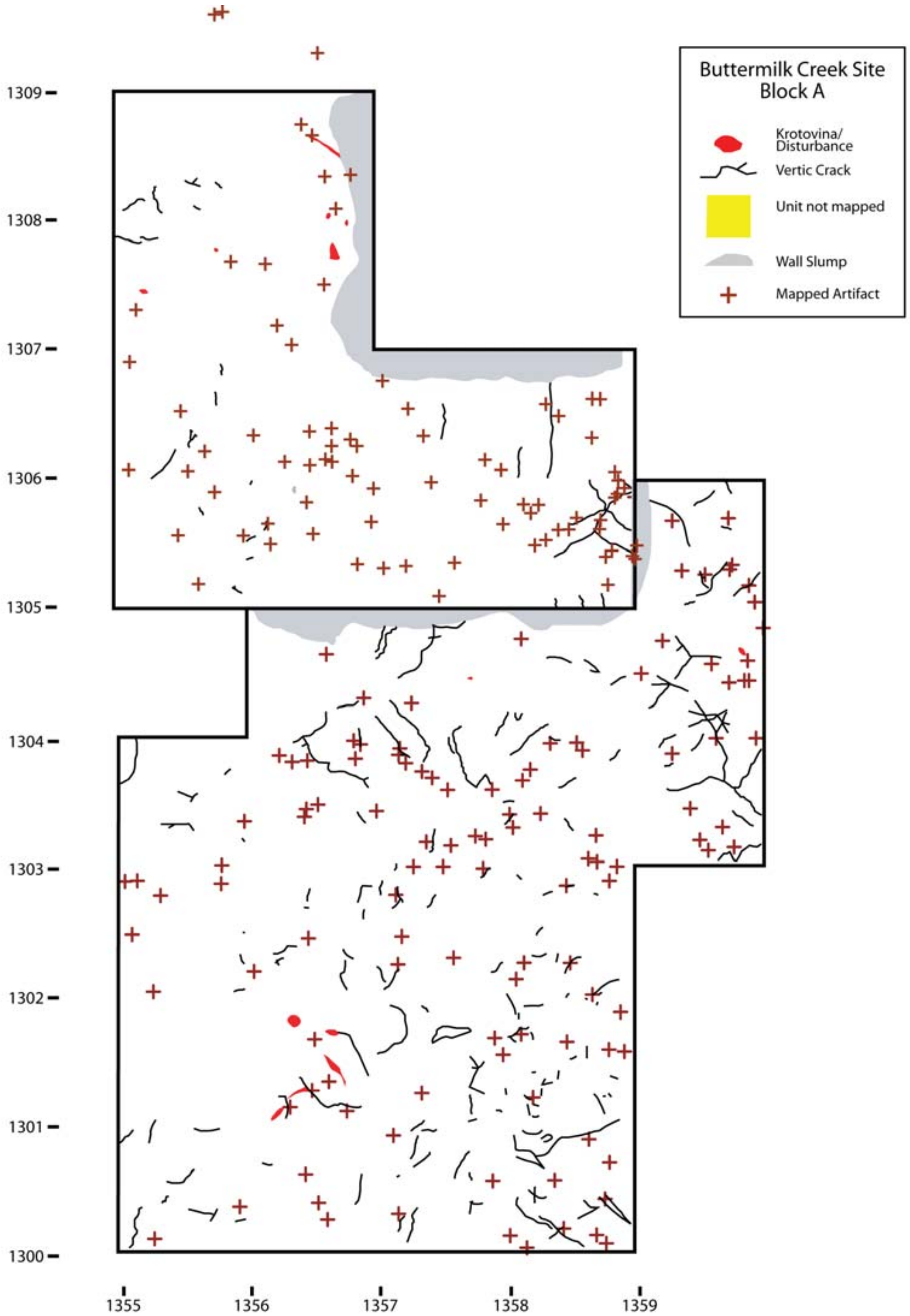
BLOCK A LEVEL MAPS

The following maps were created by splicing together level forms from the 2007 and 2008 excavations of Block A and tracing over all cracks, krotovina, and slump using Adobe Illustrator CS4. Artifact locations were plotted by entering provenience information into an excel spreadsheet for each level and uploading it into Goldensoft Surfer 6.0 (thanks to Jessi Halligan for this part!). Once artifacts were plotted in this fashion, these maps were exported as emf files and imported into Illustrator where they were superimposed over the crack and krotovina maps.

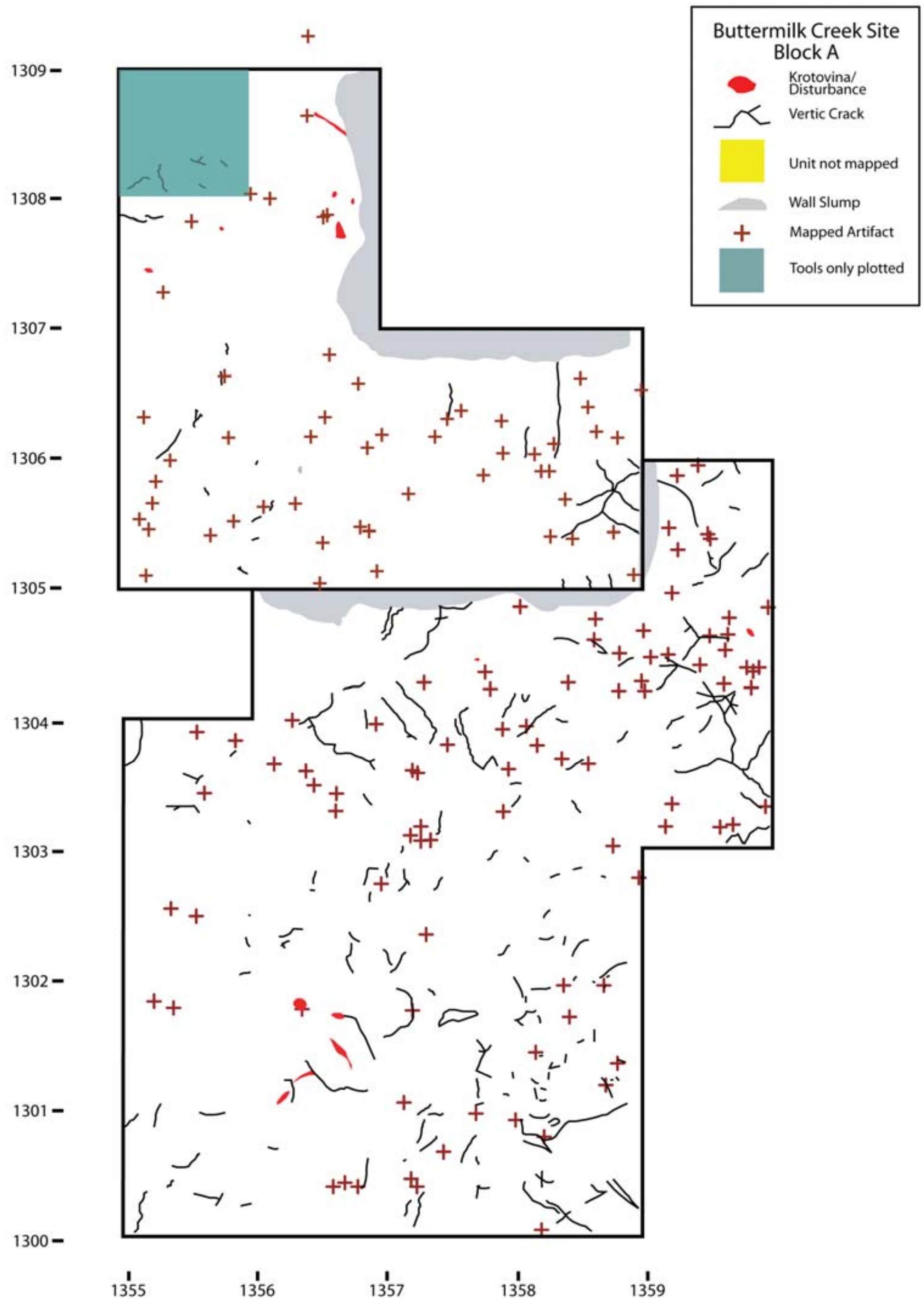
There is a map for each half level (a and b) excavated in both 2007 and 2008. However, crack and krotovina maps were only drawn in the field at the end of every "b" level. For this reason, the "a" levels use the same crack and krot map as their following "b" level (with the exception of levels corrected for the 2008 laser-level error; see Appendix B). Crack thickness was sporadically recorded in the field, though not with enough consistency to provide exact averages for each level. However, it should be noted that, in most units mapped, crack thickness rarely exceeds 5mm, and decreases with depth. Units in the eastern portion of the block between 1304 and 1306 N had few cracks between 5-10mm in thickness at level 30, though this thickness dropped to approximately 1-2mm by level 34. The remainder of the block goes from no more than 5mm thick cracks at level 30 to 1-2mm thick cracks by level 32.



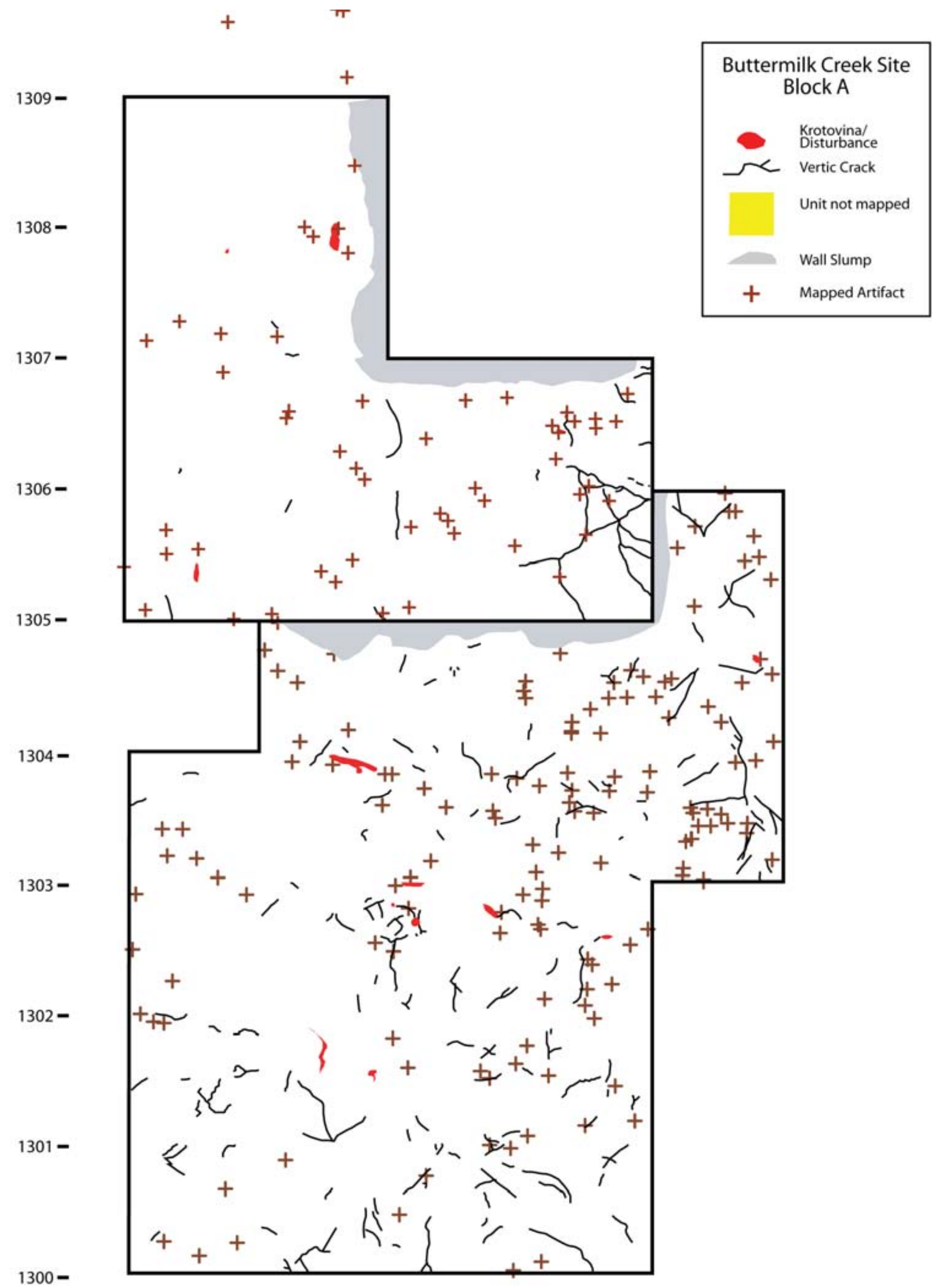
Block A
Level 30 (EL: 90.55-90.50)



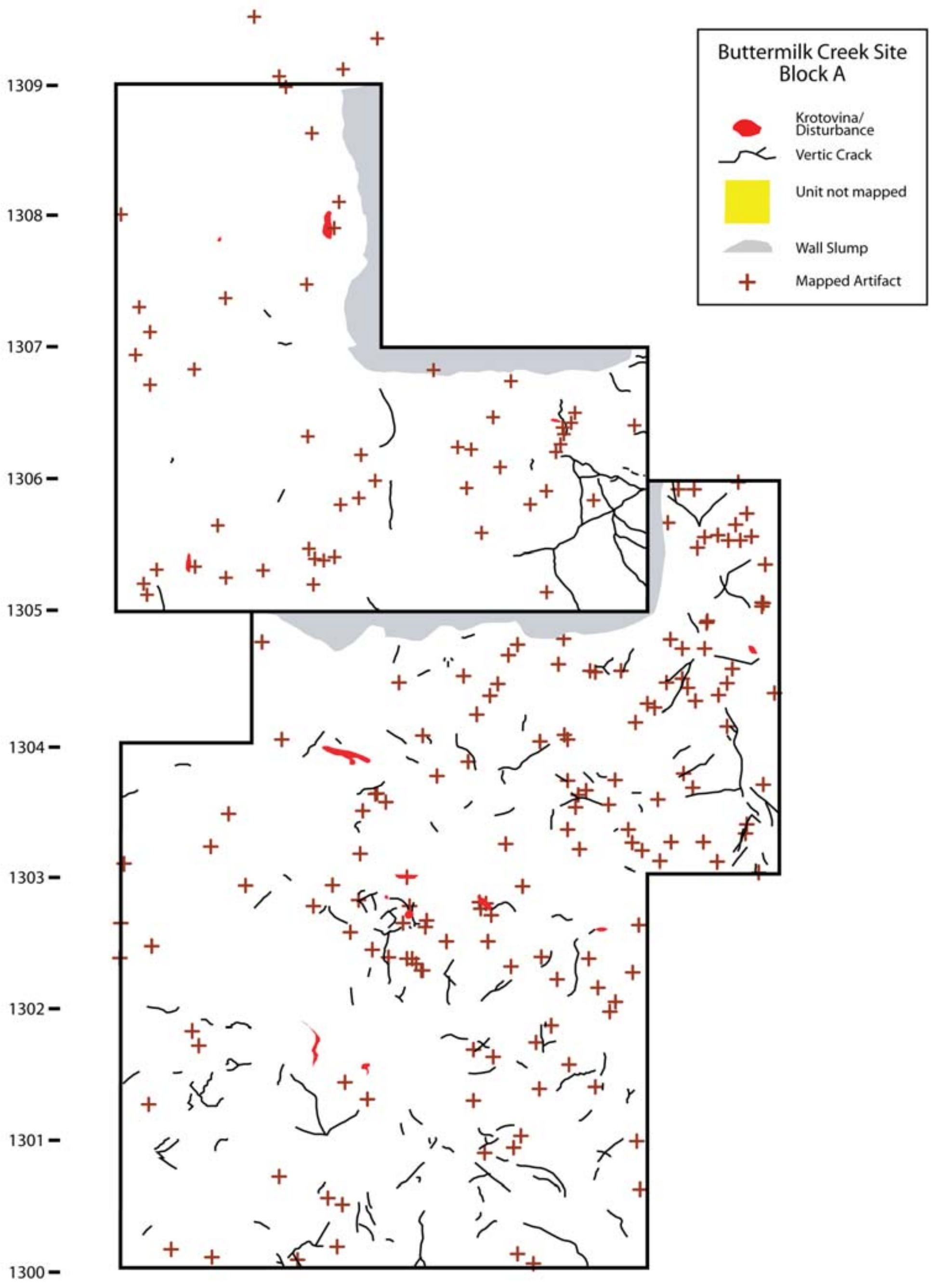
Block A
Level 31a (EL: 90.50-90.475)



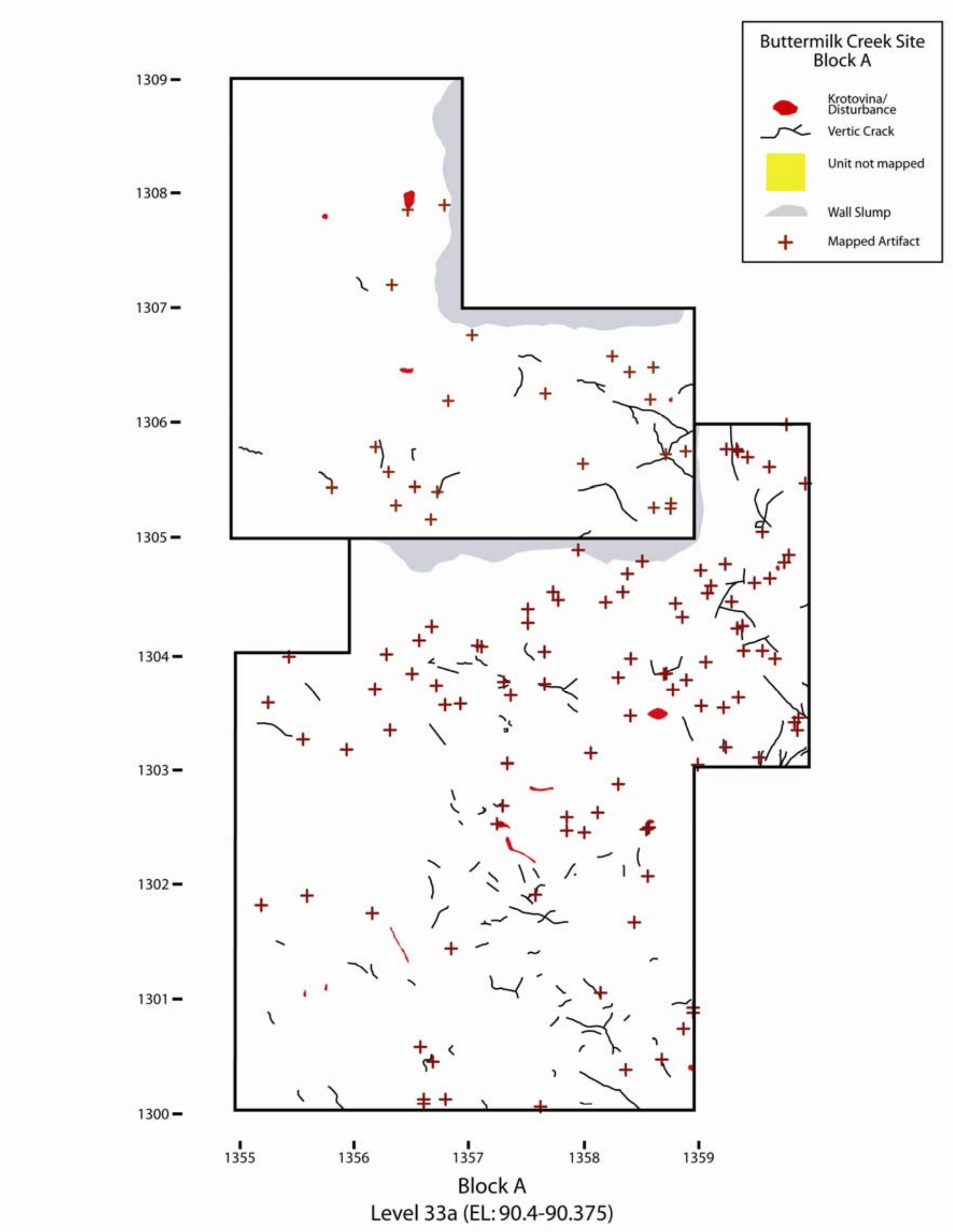
Block A
Level 31b (EL: 90.475-90.45)

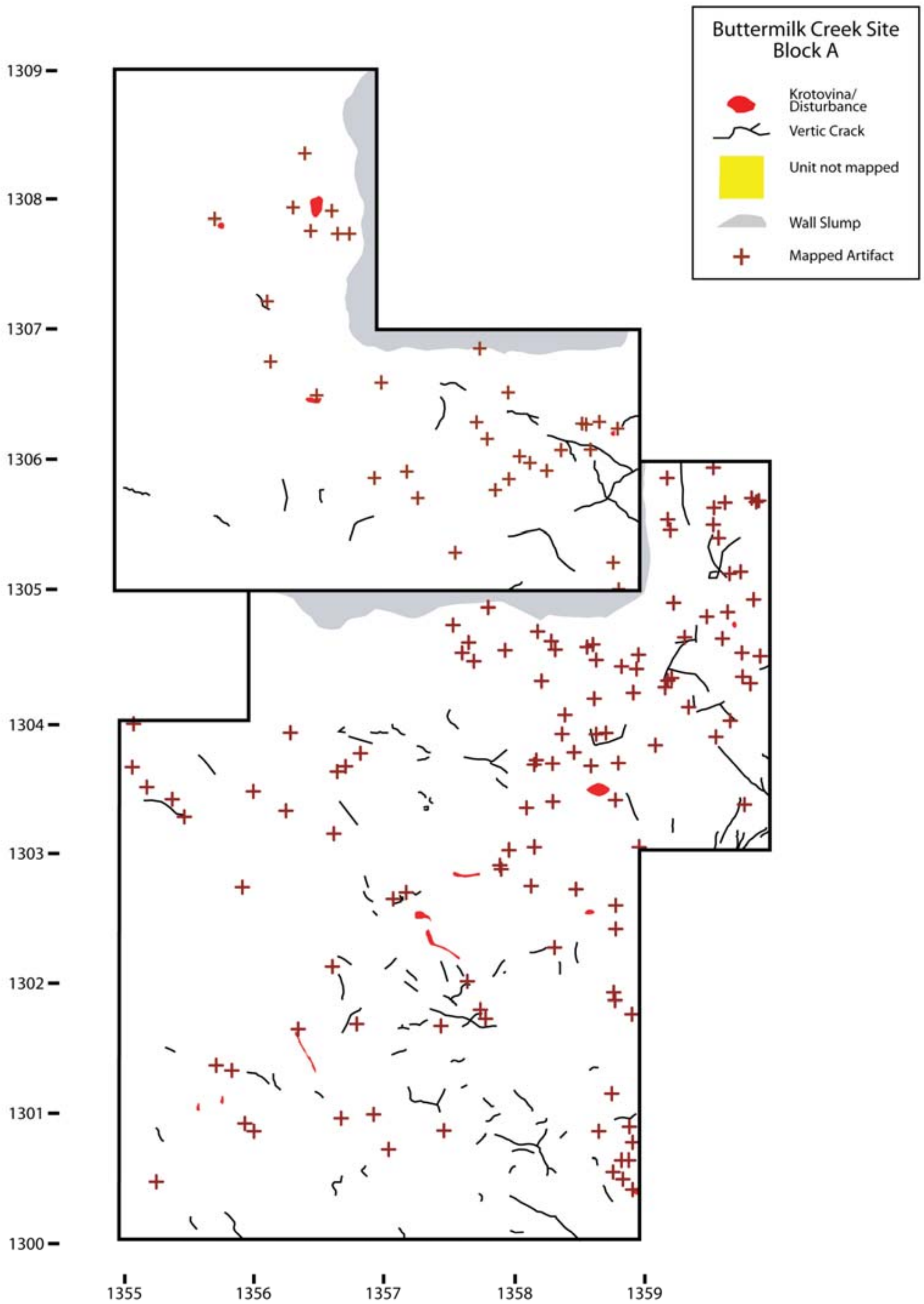


Block A
Lv. 32a (EL: 90.45-90.425)

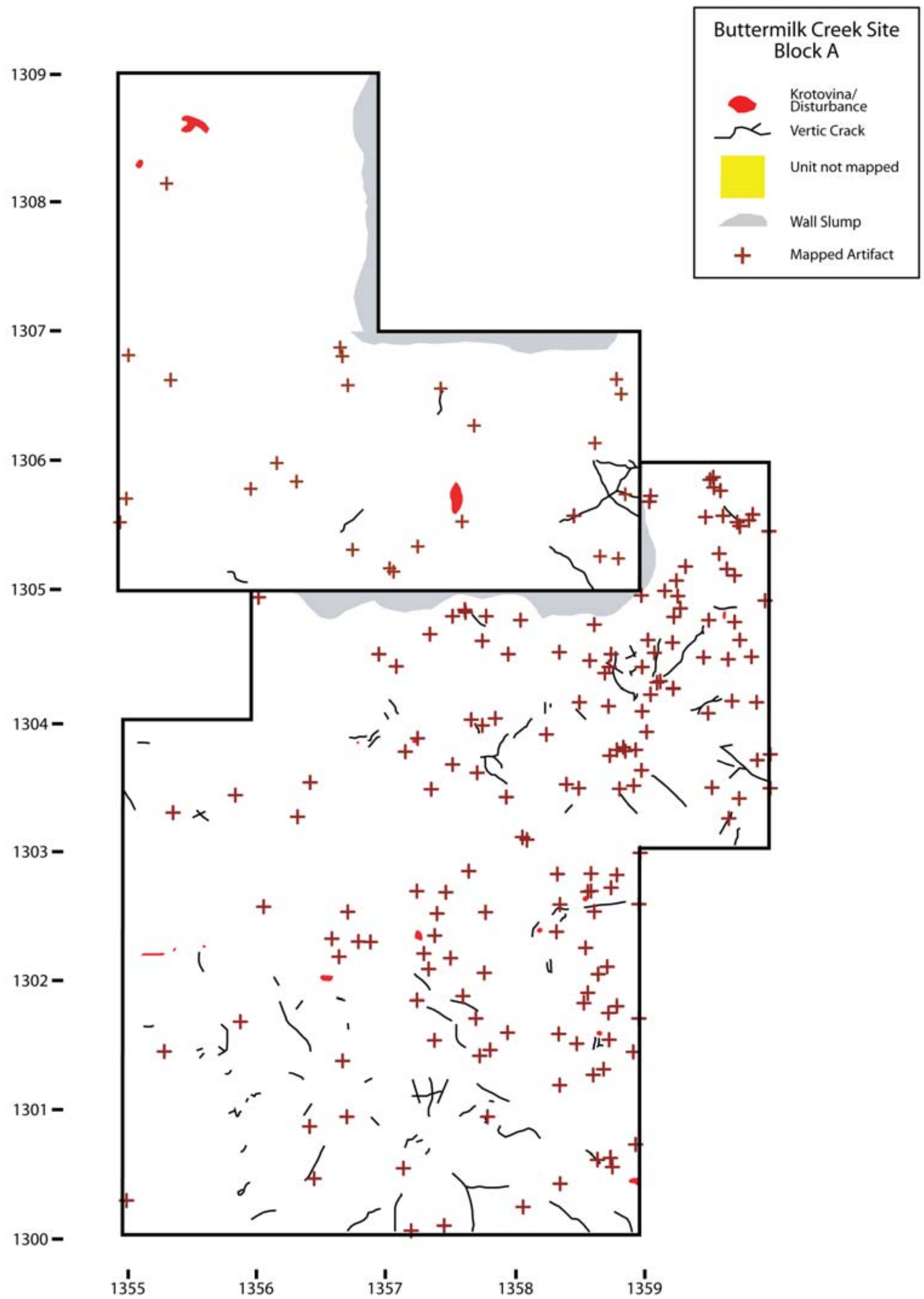


Block A
Lv. 32b (EL: 90.425-90.40)

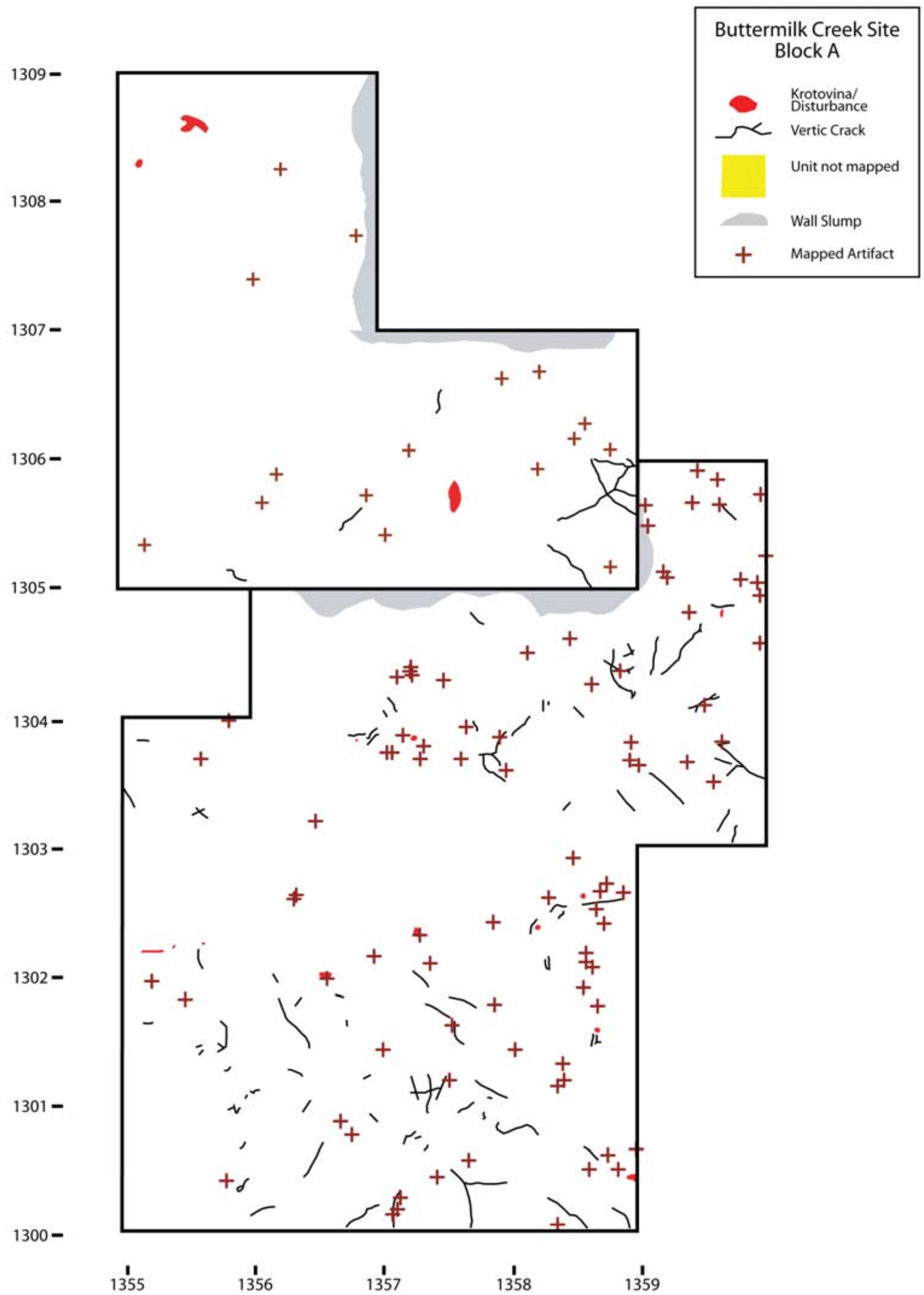

Buttermilk Creek Site
Block A
Krotovina/
Disturbance
Vertic Crack
Unit not mapped
Wall Slump
Mapped Artifact
1309
1308
1307
1306
1305
1304
1303
1302
1301
1300
1355
1356
1357
1358
1359
Block A
Level 33a (EL: 90.4-90.375)



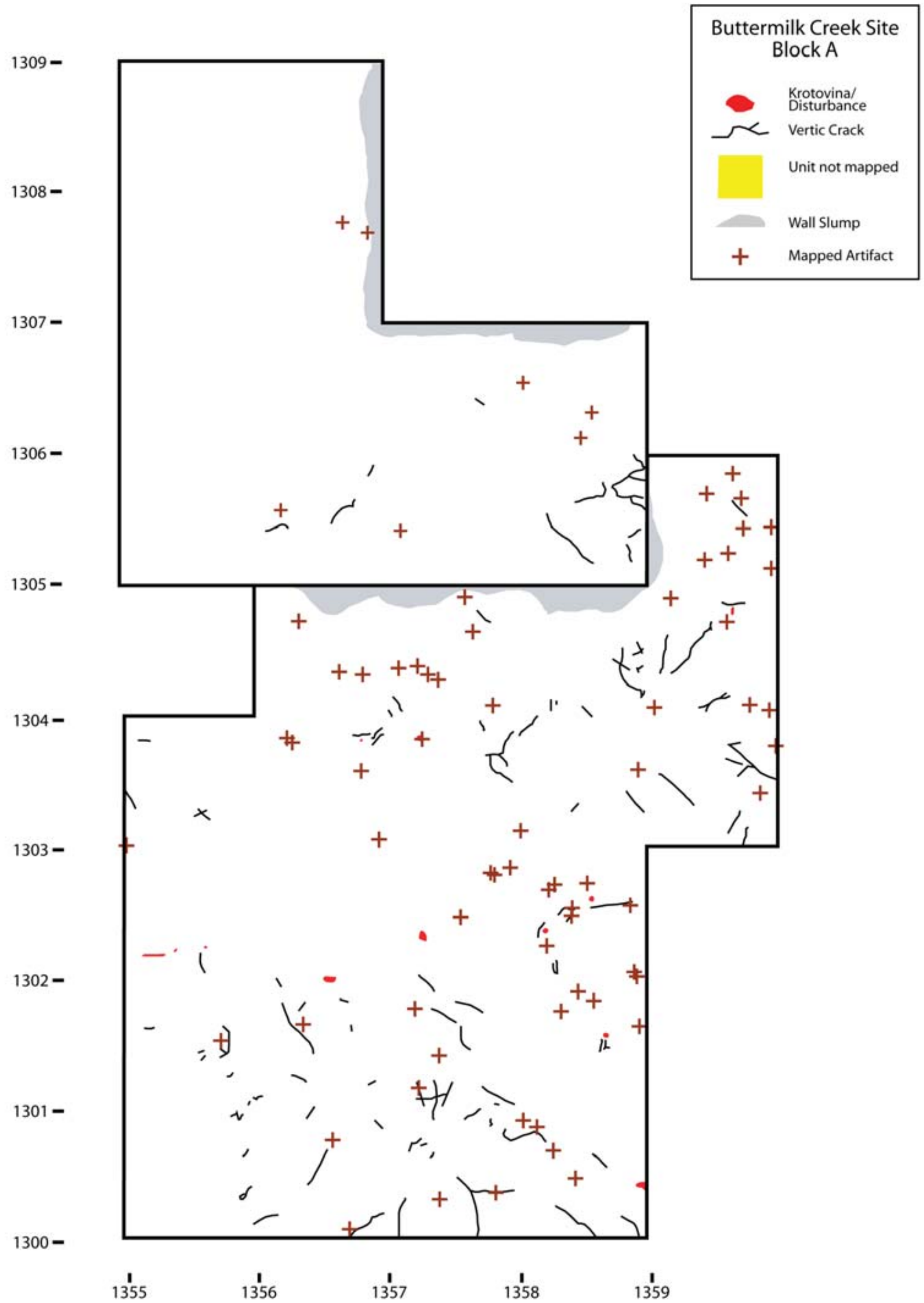
Block A
Level 33b (EL: 90.375-90.35)



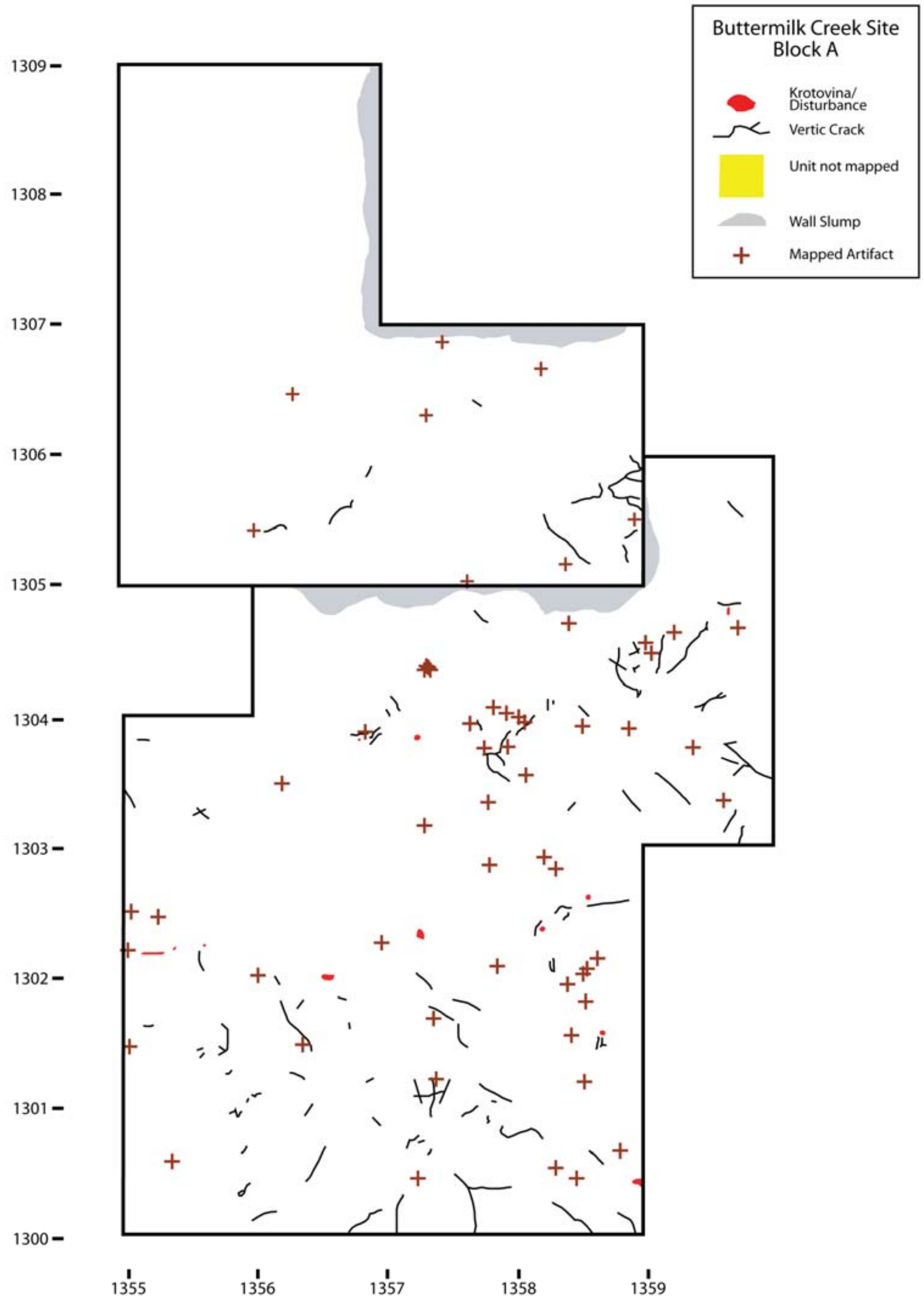
Block A
Level 34a (EL: 90.35-90.325)



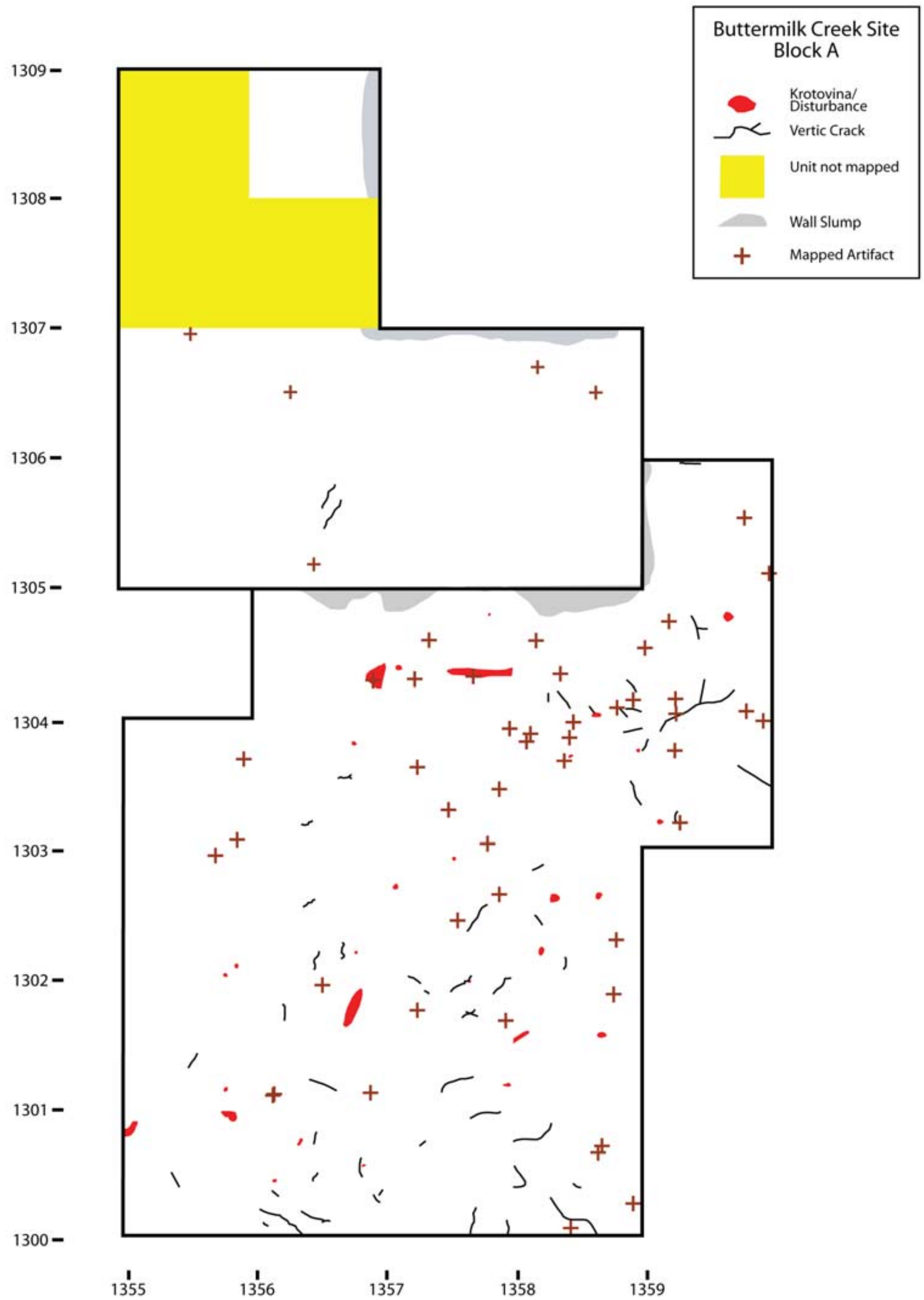
Block A
Level 34b (EL: 90.325-90.30)



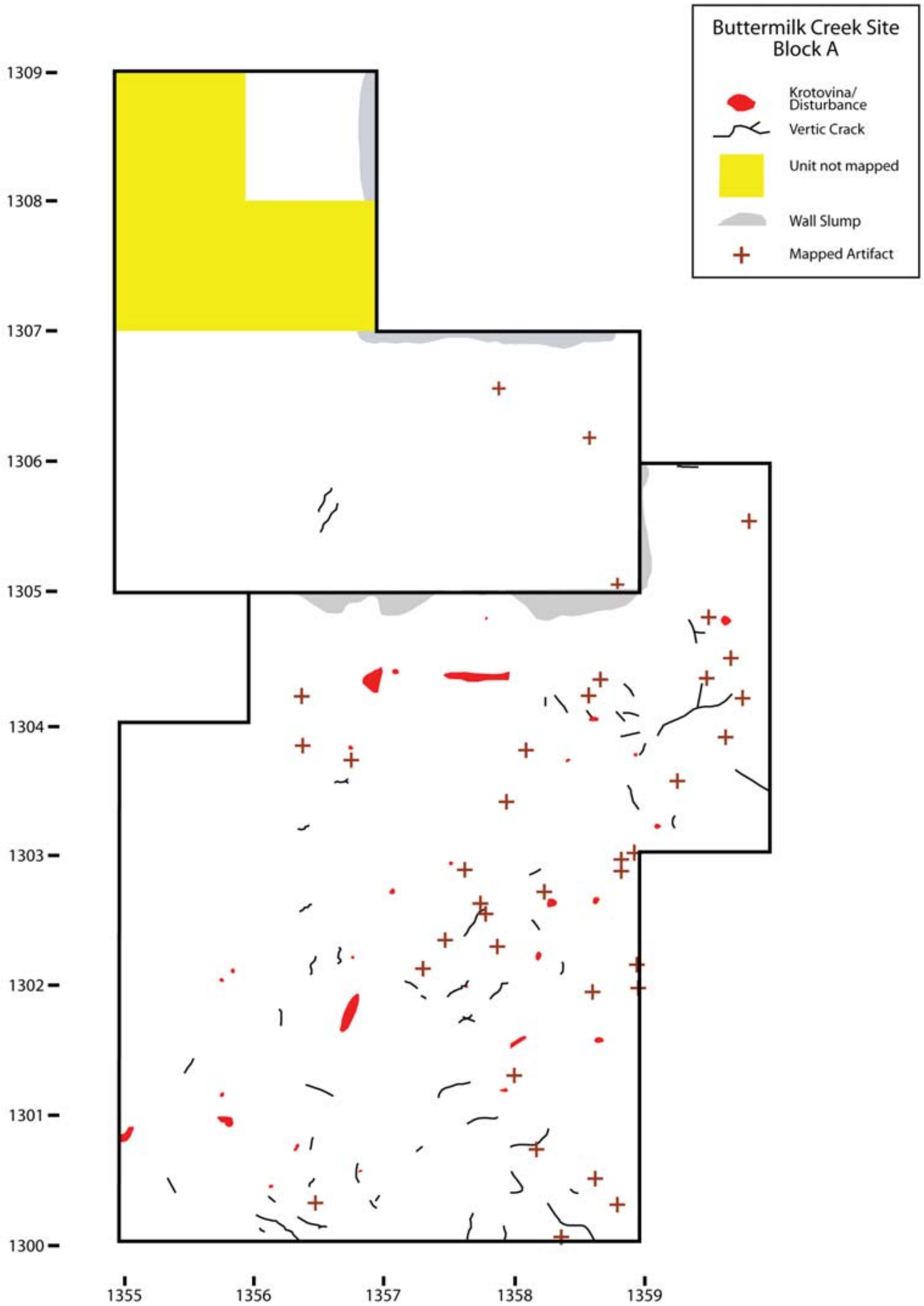
Block A
Level 35a (EL: 90.30-90.275)



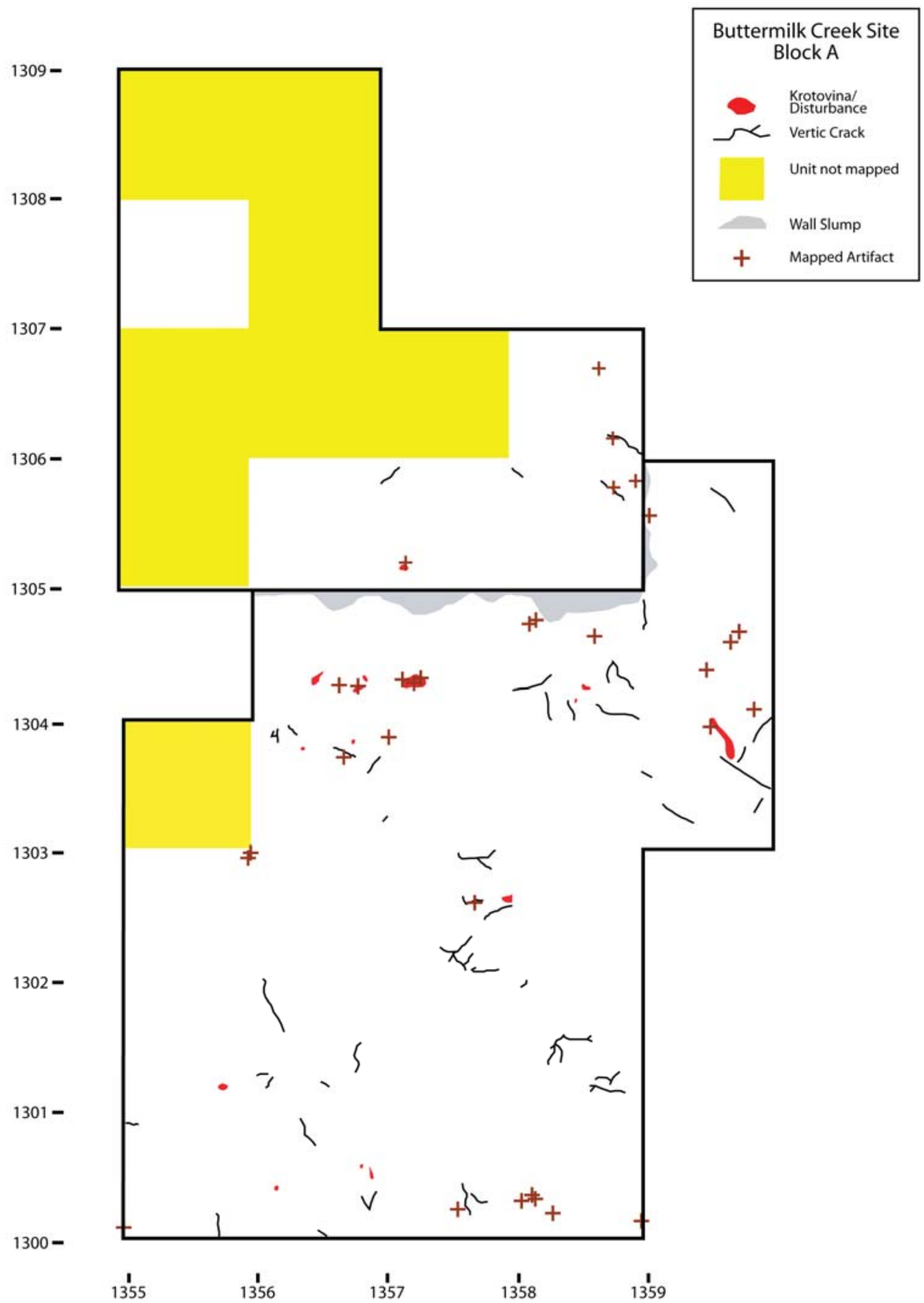
Block A
Level 35b (EL: 90.275-90.250)



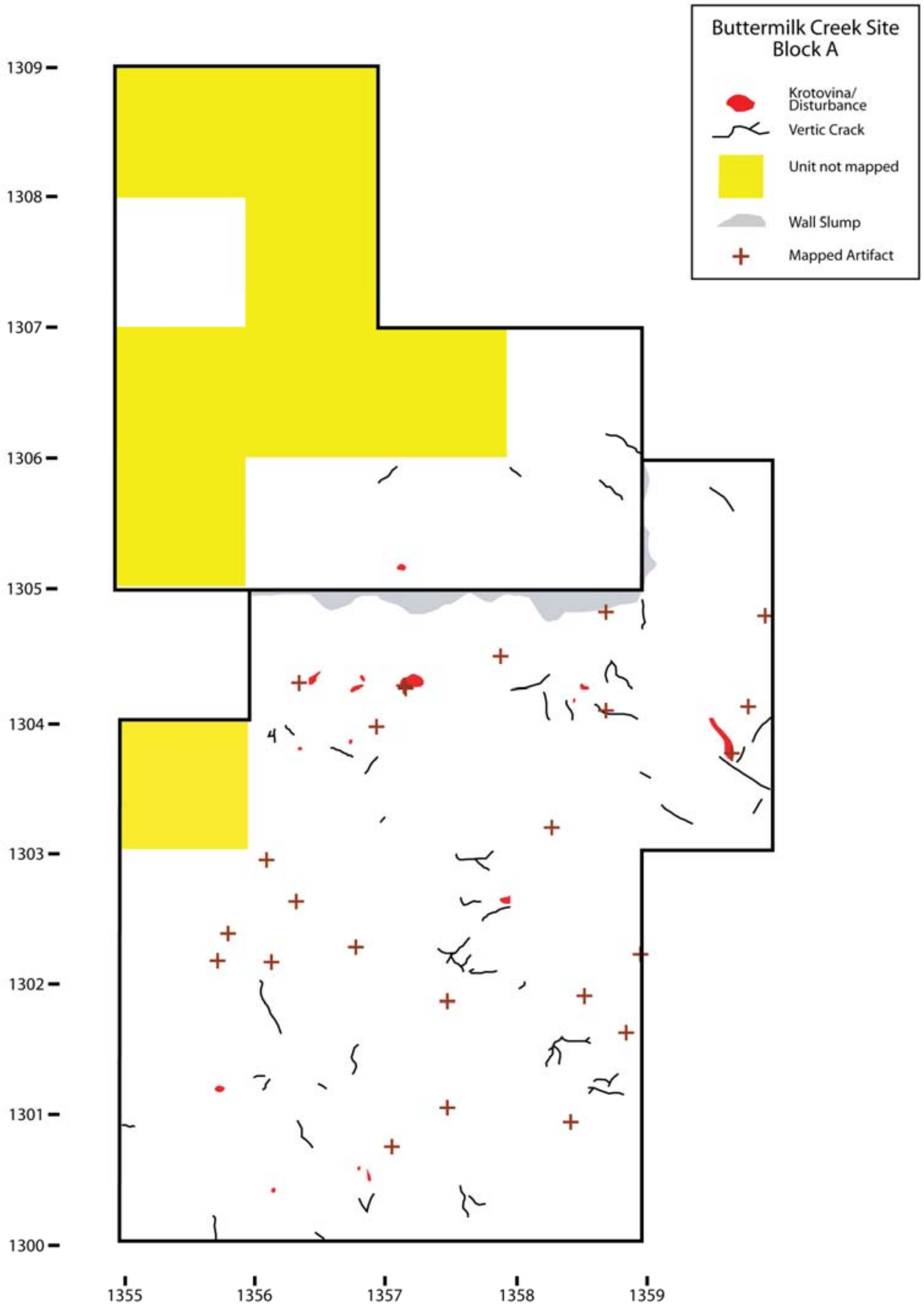
Block A
Level 36a (EL: 90.25-90.225)



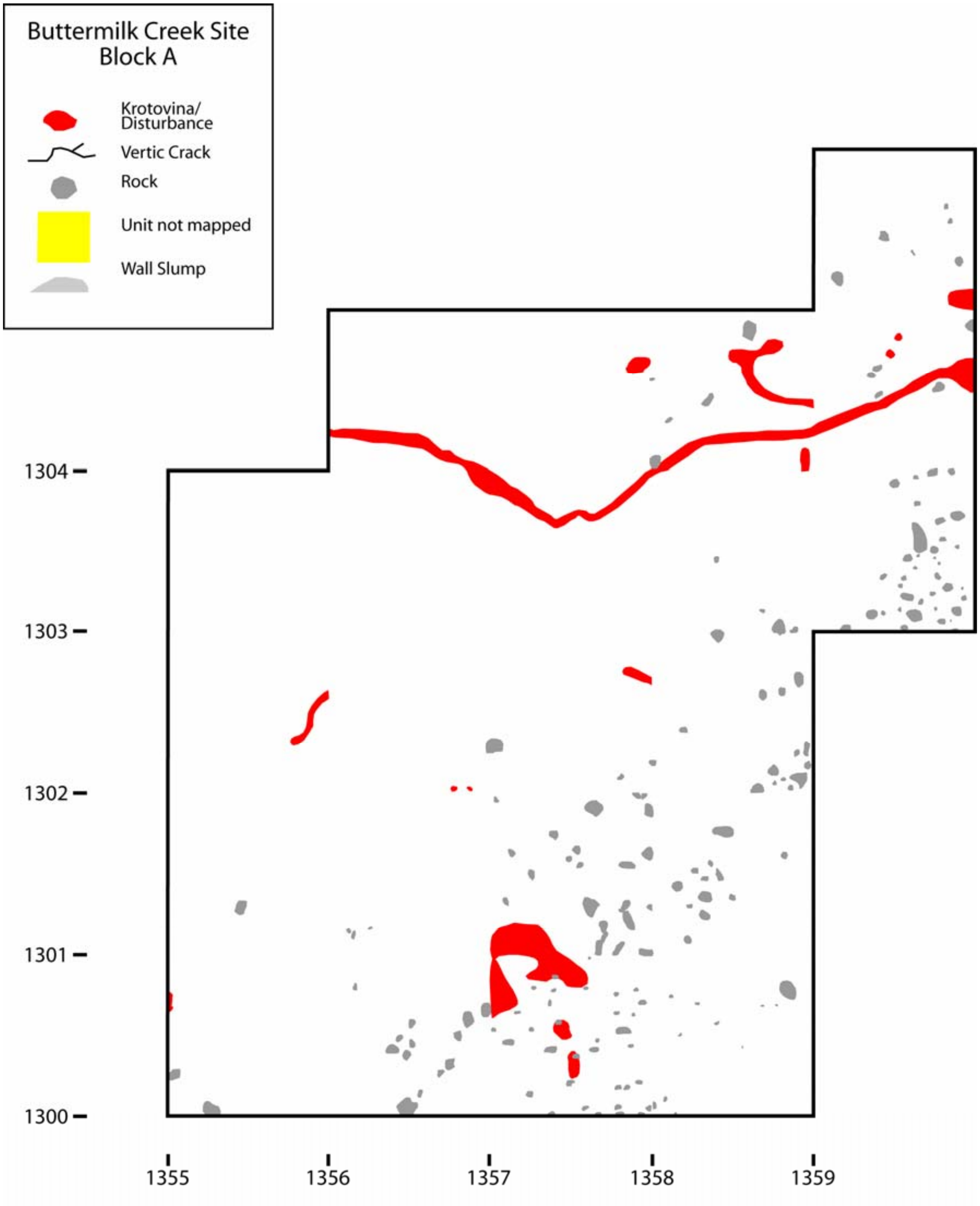
Block A
Level 36b (EL: 90.225-90.20)



Block A
Level 37a (EL: 90.2-90.175)



Block A
Level 37b (EL: 90.175-90.15)



Block A
Base of Excavation (Top of colluvium: various elevations)

APPENDIX F

PATINATION STUDY

Cultural material from the Buttermilk Creek site is almost exclusively made from local deposits of Edwards chert. The lithic artifacts recovered from Block A have different types of patina. Patination of lithic materials is caused by the deterioration of the outer surface by chemical, physical, and biological processes. Because of the wide variety of processes that can cause patination, slight changes in environmental or depositional setting can result in different types of patina formation (Krauskopf 1979). Lithic artifacts from Block A fall into three general categories of patination based on observations during excavation and initial analysis of the 2006 Block A materials.

The first category, *unpatinated*, is represented by material that is not patinated. These artifacts have a fairly uniform gray (10YR 6/1) color and the surface color is identical to the internal color of the flake. Unpatinated artifacts are most common in the Archaic horizons.

The second category, *blue/white speckled* patination, includes flakes that are a foggy bluish-gray with white speckles (2.5YR N6/, 10YR 8/1). Often artifacts with blue/white speckled patination are only partially discolored, with other areas showing gray unpatinated color. All lithics with any detecTable trace of speckled patination will be categorized as such. This patination seems to be generally associated with Late Paleoindian lithic materials.

The final category is *white* patination. Much of the chert found in the lowest stratigraphic levels is uniformly white in color (10YR 8/1). White patination first appears in association with the Clovis horizon and grows increasingly more common with deeper deposits.

The occurrence of different patinas was noted for each size class for each level from a sample of four units from the 2007 excavation (1305N, 1355E-1358E). In this way the distribution of different types of patination was be mapped throughout the stratigraphic profile to see if different types of patination could be consistently associated with specific horizons. It was hoped that while the specific processes causing patination at Block A are not well-understood, different forms of patination couldn still be associated with certain horizons.

In the lab, after size sorting, each size category was sorted into these three types of patination and results were recorded on the "Buttermilk Creek Block A Debitage Analysis Form" (see Appendix A). After initial sorting, it was decided to group "unpatinated" and "other" categories together as it became apparent that no one color represented a uniform "unpatinated" piece of chert. The final results of this analysis are shown in Figures F.1, F.2, and F.3. F.1 shows no discernable pattern linking speckled patination with size class, nor does it show any substantial change with depth (F.3). Figure F.2 shows a decrease in the percentage of artifacts with speckled patination with decrease in artifact size, but this is likely a sampling error caused by the decreased surface area resulting in a decreased likelihood of identifying "speckles." It proved nearly impossible to consistently identify particular patination types in the lab, especially when done over a period of weeks by several different people. This analysis was considered unsuccessful and was abandoned.

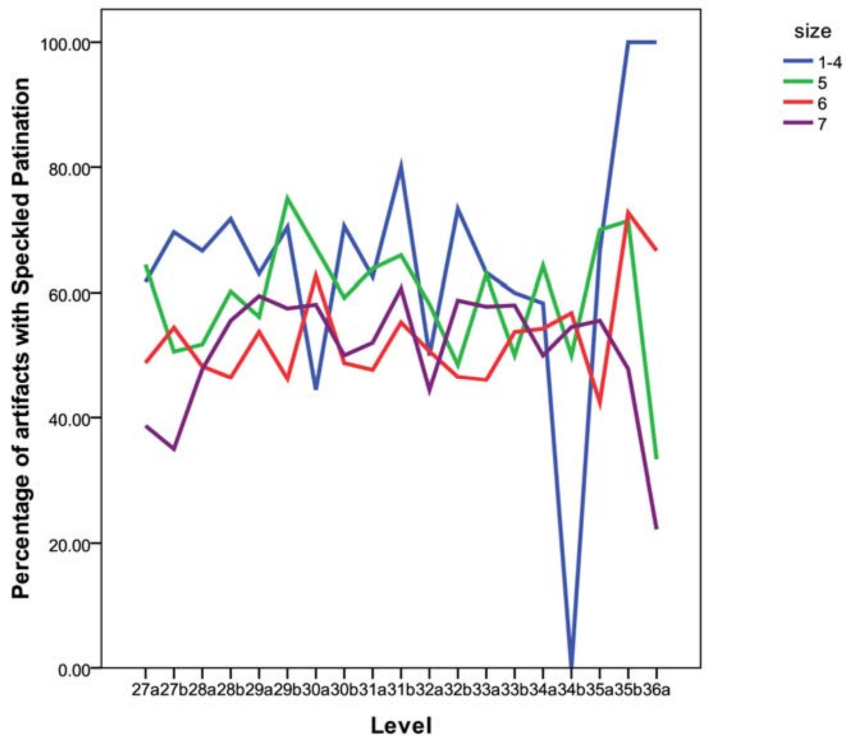


Figure F.1. Percent of artifacts with speckled patination by level size class

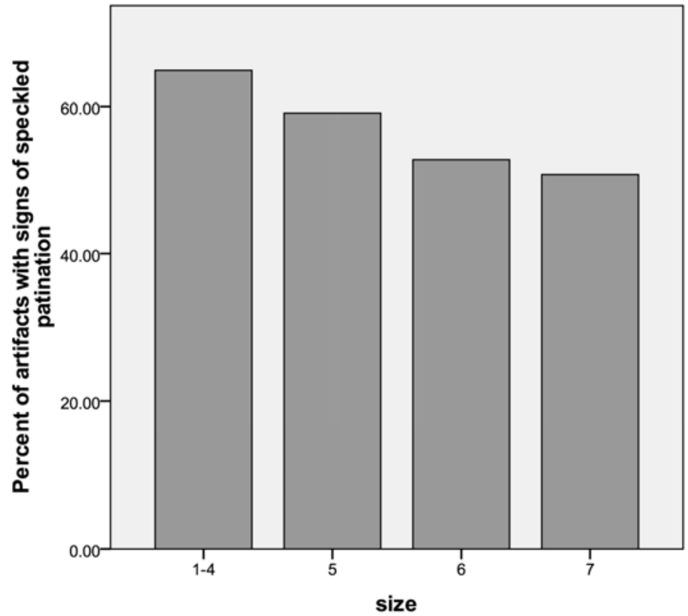


Figure F.2. Percentage of total artifacts with speckled patination in each size class

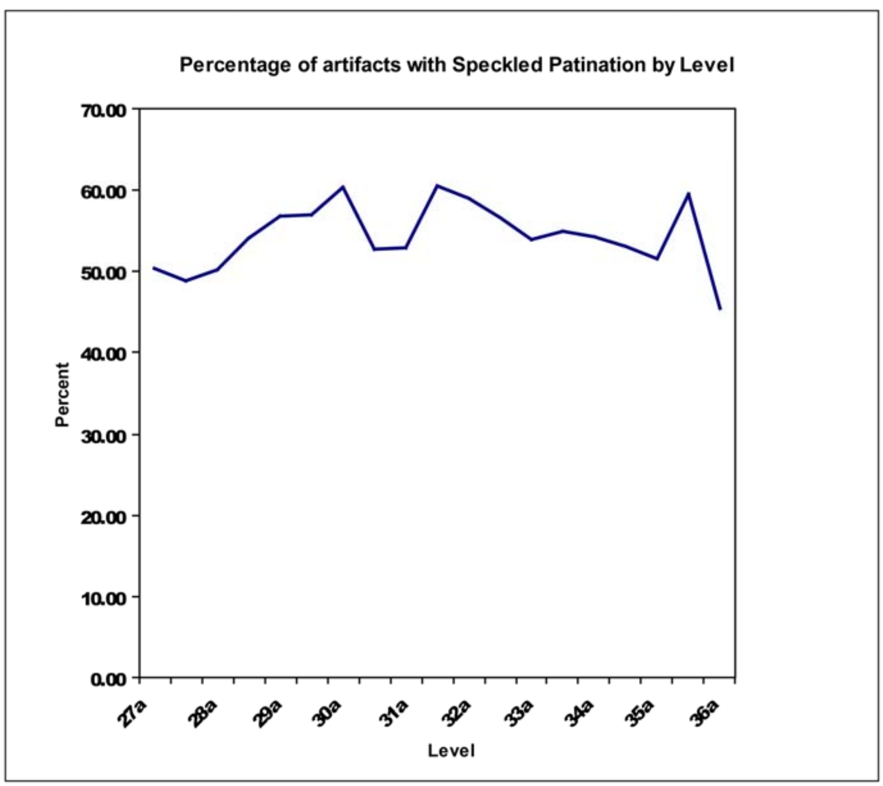


Figure F.3. Percentage of artifacts with speckled patination by level

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